FROM SHADOWS and SYMBOLS to the TRUTH

MARYGROVE COLLEGE
EX LIBRIS

l

LINEN

COMMON COMMODITIES AND INDUSTRIES SERIES

Each book in crown 8vo, cloth, with many illustrations, charts, etc., 2/6 net

TEA. By A. Ibbetson
COFFEE. By B. B. Keable
SUGAR. By Geo. Martineau, C.B.
OILS. By C. Ainsworth Mitchell, B.A., F.I.C.
WHEAT. By Andrew Millar
RUBBER. By C. Beadle and H. P. Stevens, M.A., Ph.D., F.I.C.
IRON AND STEEL. By C. Hood
COPPER. By H. K. Picard
COAL. By Francis H. Wilson, M.Inst., M.E.
TIMBER. By W. Bullock
COTTON. By R. J. Peake
SILK. By Luther Hooper
WOOL. By J. A. Hunter
LINEN. By Alfred S. Moore
TOBACCO. By A. E. Tanner
LEATHER. By K. J. Adcock
KNITTED FABRICS. By J. Chamberlain and J. H. Quilter
CLAYS. By Alfred B. Searle
PAPER. By Harry A. Maddox
SOAP. By William A. Simmons, B.Sc. (Lond.), F.C.S.
THE MOTOR INDUSTRY. By Horace Wyatt, B.A.
GLASS AND GLASS MAKING. By Percival Marson
GUMS AND RESINS. By E. J. Parry, B.Sc., F.I.C., F.C.S.
THE BOOT AND SHOE INDUSTRY. By J. S. Harding
GAS AND GAS MAKING. By W. H. Y. Webber
FURNITURE. By H. E. Binstead
COAL TAR. By A. R. Warnes
PETROLEUM. By A. Lidgett
SALT. By A. F. Calvert
ZINC. By T. E. Lones, M.A., LL.D., B.Sc.
PHOTOGRAPHY. By Wm. Gamble
ASBESTOS. By A. Leonard Summers
SILVER. By Benjamin White
CARPETS. By Reginald S Brinton
PAINTS AND VARNISHES. By A. S. Jennings
CORDAGE AND CORDAGE HEMP AND FIBRES. By T. Woodhouse and P. Kilgour
ACIDS AND ALKALIS. By G. H. J. Adlam
ELECTRICITY. By R. E. Neale, B.Sc., Hons.
ALUMINIUM. By Captain G. Mortimer
GOLD. By Benjamin White.
BUTTER AND CHEESE. By C. W. Walker-Tisdale and Jean Jones.
THE BRITISH CORN TRADE. By A. Barker.
LEAD. By Dr. J. A. Smythe.
STONES AND QUARRIES. By J. Allan Howe.
ENGRAVING. By T. W. Lascelles.

OTHERS IN PREPARATION

Photo by *R. Welch*

LINEN FLAX IN BLOOM

M78

PITMAN'S COMMON COMMODITIES
AND INDUSTRIES

LINEN

FROM THE RAW MATERIAL
TO THE FINISHED PRODUCT

BY

ALFRED S. MOORE

LONDON: SIR ISAAC PITMAN & SONS, LTD.
BATH, MELBOURNE AND NEW YORK

PRINTED BY SIR ISAAC PITMAN
& SONS, LTD., LONDON, BATH,
MELBOURNE AND NEW YORK

INTRODUCTORY

When an industry like linen has attained the magnitude of third place in our textile industries, surely little apology is necessary in sending forth this little volume in the hope that thousands, who are as yet uninitiated in all the multitude of diverse processes which intervene between the pretty flax plant in the fields and the finished dainty cambric handkerchief in the hands of Her Majesty, the Queen of England, may find both interest and instruction. Cotton may have its probable limitation with regard to its users, but linen is universal and cosmopolitan, being found in some form or other alike in the cottage of the labourer and in the palace of the sovereign.

In this work I have endeavoured to give a popular—and just technical enough not to be beyond the depths of common understanding—description of the linen manufacturing system in all its phases. It has been necessary in doing so to dip back somewhat into the past, but these chapters in the evolution of a highly important industry have not been dealt with in any dreary fashion, as bygone history too often is, but rather that the reader will get a good grasp of the foundations and evolution of the trade.

The description of cloth production, in several sections, leads up to a short account of the system of marketing. Naturally, also, it has been deemed essential to sketch, albeit briefly, the work carried on in the technical education of the linen operatives, the conditions of housing and work—with wages—in general. Condensation to a great degree has been compulsory, but my ideal has been to give a comprehensive and clear account without any burdensome verbiage of detail. If I have succeeded in so doing then I am more than satisfied.

While much of the book is from observation garnered during a lifetime spent in the heart of the linen industry, still I must acknowledge my immense obligations to Sir William Crawford, D.L., for free use of a mine of valuable authoritative information embodied in his paper read before the Royal Society of Arts in London, earning for its excellence the medal of that learned body. Much, also, especially concerning the growth of the textile manufactures in Ireland, has been derived from a Monograph entitled *Flax and its Products*, written in 1862 by the late William Charley, J.P., Seymour Hill, Belfast; and also from *Ireland and her Staple Manufactures*, published in Belfast in 1865 and owing its authorship to the late Hugh M'Call. Certainly the latter is a book of fascinating interest not alone by reason of its lore regarding linen, but its vivid pictures of life in North-east Ulster during the early nineteenth century.

Finally, I owe a big debt of thanks to Prof. Bradbury, the able Head of the Textile Department in the well-equipped Municipal Technical Institute, Belfast, for his great patience and vigilance in correcting the proofs of this work. His enthusiasm in so assisting me is quite on a par with the pride so characteristic of him in encouraging the youthful textile students to reach the highest positions possible as better workmen and more efficient managers in their respective factories and mills.

ALFRED S. MOORE.

QUEEN'S UNIVERSITY,
BELFAST.

CONTENTS

CHAP. PAGE

INTRODUCTORY v

I. LINEN IN HISTORY 1

II. FOUNDATION OF IRISH LINEN TRADE . . 9

III. THE IRISH LINEN BOARD . . . 14

THE LINEN RIOTS 17

LINEN OUTSIDE ULSTER . . . 20

OLD LINEN MARKETS 21

ENGLISH LINEN TRADE . . . 23

SCOTCH LINEN TRADE . . . 24

LINEN BOUNTIES 25

EVILS OF BOUNTIES 28

FACTORY SYSTEM INTRODUCED . . 30

ROYAL FLAX SOCIETY . . . 32

IV. IRISH LINEN TRADE AS IT IS . . 34

WAGES AND EMPLOYMENT . . . 36

WHAT THE OUTPUT MEANS . . 38

DESTINATION OF LINEN MANUFACTURES . 39

FOREIGN LINEN MANUFACTURES . . 40

V. THE RAW MATERIAL—FLAX GROWING . 42

FLAX GROWING IN RUSSIA . . . 46

VI. PREPARING THE FLAX 48

PROCESS OF RETTING . . . 48

PROCESS OF SCUTCHING OR CLEANING . 52

IMPORTS OF FLAX AND TOW . . 55

VII. THE SPINNING MILL 58

FLUCTUATIONS OF FORTUNE . . 60

HACKLING 63

THE SPREADER AND SLIVER . . 66

MEASURING THE YARN . . . 67

LINEN YARN EXPORTS . . . 68

CHAP. PAGE
VIII. WINDING, WARPING, AND WEAVING . . 71
WARPING 74
WEAVING 76
THE JACQUARD LOOM . . . 80
HAND-LOOM WEAVING . . . 82
IX. BLEACHING AND FINISHING . . . 85
FINISHING 92
PRINTING AND DYEING . . . 93
X. VARIETIES OF LINEN 97
LINEN CAMBRICS 98
MAKING OF UNIONS 100
COTTON, A FIERCE COMPETITOR . . 102
HOW TO DISTINGUISH LINEN . . . 103
XI. GRADING OF LINEN 104
HOW TO RECKON FINENESS . . . 105
SOME TECHNICAL NAMES . . . 105
THE TESTING HOUSE 106
XII. MAKING UP AND MARKETING . . . 109
MARKET DISTRIBUTION . . . 111
XIII. CONDITIONS OF WORK . . . 114
A GENEROUS ACTION 115
HEALTHFUL IMPROVEMENTS . . . 116
TECHNICAL EDUCATION . . . 118
XIV. COMBINATION AND WAGES . . . 122
WORKERS' TRADE UNIONS . . . 122
MASTERS' ASSOCIATIONS . . . 126
INDEX 131

LIST OF ILLUSTRATIONS

LINEN FLAX IN BLOOM . . . . *Frontispiece*
A TYPICAL LINEN MILL, SION MILLS, CO. TYRONE . . 35
IMMERSING FLAX FOR RETTING 49
FLAX DRYING IN STOOKS 51
FLAX BREAKING BEFORE SCUTCHING 53
SORTING VARIOUS KINDS OF FLAX 59
FLAX HACKLING AND DRESSING 61
FLAX DOUBLER 65
SPINNING 69
LINEN YARN BOILING 73
LINEN YARN DRYING AFTER BOILING . . . 75
DRESSING WARP YARN FOR LOOMS 77
HAND WARPING FOR HAND WEAVING 79
POWER LOOM WEAVING 81
HAND LOOM WEAVING 83
LINEN BLEACHING GREEN AT HILDEN . . . 87
BLEACHING. CLOTH TAKEN FROM STEEP VATS . . 89
WASH MILLS IN LINEN BLEACHING 91
FINISHING AND ORNAMENTING LINEN . . . 99
TEXTILE TESTING ROOM 107
DYE LABORATORY 119

LINEN

CHAPTER I

LINEN IN HISTORY

UNDOUBTEDLY after food the chief necessity of the human race is clothing. It may be that there are still some primal people who can exist without any dependence on garments, but these are remarkably few and fast becoming civilised. The Hindoo in his natural state required no great extent of clothing and even that of the lightest texture; and, by a wise provision of Providence, the materials for manufacturing cloth grew in spontaneous abundance around his home in the wilds of Hindostan. With a rude machine so primitive in construction as to seem impossible for any practical purpose, he spins these fibres into yarns of delicate fineness, and on a loom no less simple in its form he weaves muslin of gossamer-like texture and of the most beautiful fabric. However, it is probable that the weaving of linen was practised very much earlier in the world's history. Its antiquity is remarkable since we find it mentioned early in the book of Genesis as already in use for robing the Royal Princes of Egypt, and throughout the Bible it is very frequently referred to in terms of appreciation and as a symbol of purity and excellence. Yea, it is superfluous to refer to history in order to prove the ancient use of linen, for considerable quantities of it are actually preserved for us in Egyptian tombs, some of which are acknowledged to be of the respectable age of fifty centuries or so.

The Egyptians were experts in the weaving of linen on the loom. Examining to-day under the microscope a fragment of the linen which has formed the wrapping of a mummy we are struck with wonderment by reason of two facts, *viz.*, that it is marvellously fine, and so close in proportion to its fineness that nothing similar has been woven in modern times. Albeit this Egyptian linen is made of flax which is quite similar in fibre to the flax we use to-day. It is an interesting study to conjecture how these people were so advanced in weaving. The arable lands of Egypt, in their natural state, presented difficulties which would have deterred most people. Barren and swampy in its inland districts, and suffering every season from the overflowing of the Nile in the immediate vicinity of that great river, the aspect of ancient Egypt was about the most unpromising that could well be conceived. Yet all this did not discourage the hardy men who had determined to subdue the stubborn soil. In the art of drainage they soon made remarkable progress. In the very early ages these men performed wonders in the art of engineering—wonders that are now written about as amazing even in the twentieth century. In the course of time the people of Egypt had effectually drained their lands, dug canals, and run out immense barricades against the encroachments of the Nile. We know that in a comparatively early age of the new world's history the granaries of that kingdom formed the chief resource of less advanced and less industrious nations of the East ; and the wheat they produced had no equal in quality. But the skill of the people was still more remarkable in the culture and preparation of flax, and in all the processes required for the conversion of the raw material into the web of cloth.

" Fine linen " was the peculiar manufacture of

Egypt. From a very remote date it would appear that the product of the flax plant had been set apart as the court-garb of royalty in all the eastern states, and that its use was coeval with the establishment of the regal office itself. We learn, too, that monarchs of old presented " robes of fine linen " to their especial favourites. When Pharaoh's magicians and wise men failed in their attempt to interpret their royal master's vision, and when the persecuted Hebrew readily solved the problem, the King, in his enthusiastic gratitude, arrayed Joseph with his own hands in a " vesture of fine linen." At all the national festivals, when the priests appeared in the full glory of official dignity, the most costly and beautiful portion of their dress consisted of coloured and white linen.

It is a fascinating study in economic history to try to compare the Egyptian manufacture with that prevalent to-day. Of necessity the process by which the fibre of the flax plant was carried through its successive stages was exceedingly slow, so the finished article had thus imparted to it a value which placed it beyond the reach of all but the princes and great men of those ages. The raw flax went through all the different stages of manufacture by the agency of the hand alone, and the spinning of the yarn was performed only by the distaff. Several of the Egyptian sculptures and paintings afford us full evidence of this fact. The loom was of very rude construction, and yet the description of fabric produced in that primitive machine would astonish some of the celebrated cambric weavers of the present day. It is probable, however, that the Egyptian operative of the time of the Pharaohs, did not weave three yards of cloth in any week from the commencement of his web until it was finished. One of the most celebrated authors states that all the labour connected with the pulling and preparing of flax, the spinning of the yarn, and weaving of the cloth was performed by men. While the "lordly" portion of Egyptian humanity thus became domesticated by the linen manufacture, and while their daily labour was confined to the neighbourhood of their homes and their flax fields, the women were busily employed in general traffic, journeying about to make household purchases, or performing the more ordinary and fatiguing labours which, in general, are considered as belonging to the other sex.

Alike with the manufacture of linen the art of finishing the fabric in the white state, as well as the more scientific operations involved in the printing of landscapes and designs on the plain cloth—these were practised by the Egyptians in these early days. Several centuries later we find it stated, that among the imports into Chaldea were "fine linen, with embroidered work from Egypt, and blue and purple from the Isles of Elisha." Moses declares that one of the most skilful of the workmen employed by Bezaleel in fitting up the inner parts of the ark was Aholiab, who was "an engraver and a cunning workman, an embroiderer in blue, and in purple, and in scarlet, and in fine linen."

Now while we have been discussing the part played by the Egyptians in linen it is remarkable that simultaneously the ancient Phoenicians—a people dwelling by the shores of the Red Sea and on the lands bordering the Persian Gulf—had also made considerable progress in commercial enterprise. They traded with most other nations, and though it does not appear that they themselves had ever cultivated the art of growing flax, or making cloth to any extent, their regular visits to Egypt gave them such insight into the practical working of manufactures that they were well able to impart to natives of distant lands very valuable information on those subjects. As a wild and wandering people the Phoenicians were possessed of remarkable energy, whether as referring to maritime, mercantile, or manufacturing pursuits. Mount Libanus, as we can infer, supplied them liberally with timber for the purposes of naval architecture, and the iron and copper mines of Sarepta gave them abundance of these useful metals. Famed as the manufacturers of the highly valuable dye which produced the celebrated "purple" of the ancients, they had become adepts in the colouring of cloths, woollen as well as linen, long before the people of most other nations had even thought of the subject. More speculative in their trading pursuits, and, as we have seen, more commercial in their habits than the natives of any other of the Eastern states this enterprising race took every advantage of extensive coasting facilities. They were famed navigators, and possessed fleets of ships which, even in that day, were able to extend their commerce into the most distant regions. Is it not more than possible that these merchants of Phoenicia not only exported linens—plain, coloured, and wrought with fanciful designs—to the several nations which they were in the habit of visiting during their trading voyages, but that they also imparted to the people of those countries the art of manufacturing such goods?

Ireland is said to have been originally colonised by Phoenicians. If this be true we can easily imagine that the settlers would very soon afterwards have applied themselves to their national industry.

Hitherto we have dealt with what may be termed the Prehistoric period with regard to the linen manufacture so now it behoves us to make a big jump over centuries. Hitherto, also, our information has been rather traditional, but if we must accept data, linen weaving appears to have been existent in Ireland prior to being so in either Scotland or England. Macpherson states that in 1210 the linen trade was in a very flourishing condition in Ireland. The principal seats of the northern trade were at Ard-Macha (Armagh), Bally-Lis-nevan (Newtownards), and Beanuchar (Bangor). When Bangor was plundered by the Danes, the sacredness of its old abbey did not preserve it from becoming common spoil, and among the property carried away by the ruthless invader were many vessels of gold and silver and vast quantities of fine linen and scarlet robes. The manufacture of both linen and woollen fabrics seems to have been very extensive in Ireland during the reign of Henry the Sixth, as there was then a large export of such goods carried on for the English market; and in different parts of the continent the Irish manufactures were popularly known and highly valued for their superior texture. A writer who lived in the reign of Queen Elizabeth and who had made the tour of "John Bull's Other Island," told his English readers that "the natives or wild Irish had such plenty of linen cloth, that they wore thirty or forty ells in one shirt."

Perhaps one of the most extraordinary events in the annals of the Irish linen trade is that associated with Earl Strafford, when Lord Deputy of Ireland, during the seventeenth century. There can be no doubt that the strong-minded Earl meant to do good. His way was autocratic in the highest degree yet he sought to give impetus to the growth of the linen trade. The originator of many improvements, he brought over from the Continent a number of spinners and weavers, who taught the Irish the superior systems of treatment in operation there. The pity was that Strafford did not use more tact and persuasion rather than tyranny and ruthless coercion in striving to make the Irish linen workers do as he desired.

One gentleman stated before the then Irish House of Commons that large quantities of linen and linen yarns, which had not been manufactured according to the plan laid down by Strafford's proclamation, were seized and carried off, and that the entire province was thrown into the greatest alarm and excitement, and that as a consequence greatly increased animosity towards the "Sassenach" was produced in the minds of the natives. This accusation may have been true—for it is stated over 1,000 persons lost their lives by the Lord Deputy's edict. However, it is only fair to his memory to remember his defences. It was that in his desire to improve the whole system of manufacture, he imported into Ireland the finest flax seed that was to be had in the Low Countries—that he sold the seed out to the farmers at cost price—and that when he took up the subject the trade was in a very unsatisfactory state, the breadth of linen did not exceed a foot, the yarn was irregularly spun—and the length of flax twelve inches; whereas under his system the breadth of linen was made twenty inches—the yarn was regularly spun—and in consequence of the superiority of his imported seed the length of the flax had increased to three feet long. All the reforms he had urged were intended for public good. But public prejudice against Earl Strafford was too strong to save his life since he was found guilty, condemned, and afterwards beheaded at Whitehall in May, 1641, about eight years before the execution of his royal master, Charles I.

A more prudent system of patronage was bestowed on the linen manufacture after the accession of Charles II. It is a curious circumstance that, during the reign of this monarch, the extension of the Irish woollen manufacture appears to have made such rapid strides that the jealousy of the English manufacturers was aroused. Protection in its most bigoted form was the practice of those times, and, consequently, we find an Act passed by the British Parliament prohibiting any export of wool from Ireland except to England and Wales. Not content with this stricture, in the tenth year of William III, another Act was passed founded on the report of a special committee, forbidding any export whatever from Ireland of wool or woollen manufacture. The reasons given by the committee for their recommendation were, that the English trade must be preserved, and that wool and labour being so much cheaper in Ireland than in Great Britain, the English manufacturers could not compete at all successfully with those of Ireland. The woollen trade being thus reduced to the quantity required for home consumption, of course, rapidly declined, and its place was soon taken by the linen manufacture. I have mentioned the encouragement given to Irish linen during the reign of Charles II. Laws were then passed for its encouragement, and premiums given liberally for the finest webs of thirty-six yards long. At that period the total value of all linens exported from Ireland only amounted to about £10,000, while the exports of woollen goods, which were then largely manufactured, averaged £110,000.

CHAPTER II

FOUNDATION OF IRISH LINEN TRADE

THOUGH Belfast, known by reason of its great textile trade, as " Linenopolis " has many fine streets, handsome buildings, and noble statues there is one memory ungratefully overlooked. It is a memorial to its great pioneer in the linen manufacture which, like its ships, has made the Irish city world-famous. No monument marks his memory in the city which has benefited so vastly from his practical example. Still, the modesty which marked Louis Crommelin during his life is that which he probably desired should be his memento in ages to come. His record is a reminder for ages to come. In the eastern corner of the graveyard that surrounds the Lisburn Cathedral—eight miles from Belfast—the ashes of many of the French exiles who made Ulster their refuge have long reposed. On a curious old tombstone the inquirer may find this inscription : " Six foot opposite lyse the bodye of Louis Crommelin, born at St. Quintin in France, only son to Louis Crommelin and Anne Crommelin, Director of the Linen Manufactory, who died beloved of all, aged 18 years, 1 July, 1711." It is probable that this monumental stone had also a record of the death of the elder Mr. Crommelin, but the letters which had been engraved on the lower portion of the tablet have long since been totally defaced, Mr. Louis Crommelin died in 1727, aged 75 years.

A little space may be spared to the career of this gentleman so described as " Director of the Linen Manufactory." The intolerance of the Acts of Louis XIV, which sent upwards of half a million of the most industrious of his subjects as exiles from the shores of France, scattered those people abroad over most of the other nations of Europe. A great number of them settled in Lis-Na-Garvagh (now Lisburn, near Belfast). Others located themselves in the Irish metropolis where they commenced the silken manufacture, and a few sought out other homes in some of the southern counties. These Huguenots when in their native land, had been chiefly employed in the manufacture of silk and the finer fabrics of linen. Almost immediately after reaching the place of their adoption, they commenced work, imparting to those around them the skill and energy which they had been wont to exercise when peacefully settled in the land of Gaul. About that date an Act had been passed by the Cromwell parliament prohibiting the import of French linen or cambric, and consequently the demand for such goods had largely increased in Ireland and Great Britain.

In the reign of William III, and many years after these Huguenots had first settled in Lisburn, Mr. Louis Crommelin joined the colony. Originally hailing from St. Quintin, in Picardy, where his forefather had carried on linen manufacture, his family had fled to Holland there to become merchants and bankers. So it was on the personal request of the Prince of Orange that he later transferred himself, in 1698, to become head of the Huguenot colony at Lisburn.

Mr. Crommelin was practical in a supereminent degree. He brought over with him a number of Dutch looms of the most improved kind. Simultaneously with the vast improvements in the linen looms he introduced another and no less valuable innovation in the form of the spinning-wheel, the music of which was, for nearly a century and a half, the glory of the small farmer's ingle nook. Previous to the advent of the French refugees the distaff and spindle were the only means of spinning flax yarn. Even the looms on which the weavers of Ulster then wove their linen webs were of very primitive construction, and, as machines, they were comparatively ineffective in their operation. However, a new era had now dawned.

The machine so long known as the Irish spinning-wheel, though simple in its form and mechanical arrangement, wrought wonders in the primary stages of the linen manufacture. So yarn of a very superior class to any previously spun was thrown off by practised hands. With the improvements of the heddles and reeds of the loom also there was introduced another huge reform—for now " the reel " was first brought into use. It does not appear that during the reign of the distaff and spindle any regular mode of measuring yarn into " cuts " and " hanks " was practised by spinners.

Crommelin's part in furthering the Irish linen industry cannot be dismissed in a sentence. The manufacture of linen until the industrial revolution period was essentially domestic in all its details. Farmers raised flax on their own lands, the straw was scutched at home, the daughters and servants spun the yarn, the sons wove the linen, and the bleaching of the cloth was effected by the same hands. The law passed by Charles II, which rendered it imperative on all cultivators who farmed thirty acres of land in Ulster, to sow at least three bushels of flax seed annually, and which granted certain premiums to the most successful growers, had great effect in extending the linen trade. And now Crommelin, backed up by William III, was doing still more. Farmers were taught better methods of growing and treating flax, and now there was another forward move in the establishment of a bleaching concern. After considerable difficulties these works, including a large area for grassing the linens, were opened at Hilden in 1701. Alkalies were then being brought into very extensive use for the preparation of the cloth before spreading it out on the bleachfield. At the same time there was much difference of opinion on several points, and especially respecting the action of lime, which many persons supposed would injure the cloth and make it less durable for wear. On this subject there had been a good deal of bitter discussion in Parliament, and ultimately a law was passed prohibiting on pain of fine and imprisonment any bleacher from using that article for such purpose.

We have seen how active was William III in his encouragement of Irish linen, and two years before his death a patent was issued granting £800 a year to Mr. Crommelin as interest for the capital—£10,000—which he had invested from his own private resources to carry on the different works in which he was engaged. In addition to this " grant " there was also allowed £200 a year as an annuity to Mr. Crommelin, besides £120 for three assistants. It seems the pitch of baseness, however, that almost immediately after the accession of Queen Anne the annual grant made to Mr. Crommelin was refused by the Imperial Treasury. No excuse can be made for this flagrant breach of faith. In fact, the annuity could not be termed a Royal pension, but rather a sum paid as interest on the capital which Mr. Crommelin had invested for a public purpose, and which the previous monarch considered had been permanently secured to that gentleman for the twelve years mentioned in the Royal patent.

Despite this disgraceful proceeding there was withal some satisfaction left to the Huguenot linen pioneer. When the Government of Queen Anne thus stopped one portion of the supplies which had been granted for the encouragement of the linen trade, the capital alluded to was scattered throughout Ulster, in the shape of looms, spinning wheels, machines for scutching flax, and bleaching apparatus, all of which had been lent to weavers, spinners, farmers, and owners of small bleach-fields—not more than one-half the value having been repaid. It must, however, have been highly gratifying to the founder of the improved system of linen manufacture to watch the growing success of his projects, and to see the rapid changes which extended profits and higher wages had produced in the circumstances of manufacturers and weavers.

CHAPTER III

THE IRISH LINEN BOARD

In a multitude of quarters there was abundant evidence to prove that the labours of Louis Crommelin had not been in vain. The Board of Trustees, instituted for the promotion of the flax and hemp manufacture in Ireland, was appointed by an Act passed on 6th October, 1711, under the ninth of Queen Anne. Undoubtedly this Board commenced under the most favourable auspices for it was helped by an annual grant from Parliament of £20,000. Intelligent inspectors were also appointed in the country districts, and it must be admitted that not alone Ulster but the country at large participated in the advancement which was along the most liberal and progressive lines. One item from the Minutes will show the consideration shown by the Board. Thus in June, 1815, Mr. Jas. Barklie, a respectable linen bleacher of Linen Vale, near Keady, being summoned to attend before the Rev. N. Smith, a magistrate of the county, to answer a grievous complaint against him—to wit, using lime in the whitening of linens in his bleach yard—the linen manufacturers of the neighbourhood called for the protection of the Board of Trustees. Their petition alleged that " if the law in this case should be acted upon, it must prove ruinous to Mr. Barklie as an individual, and destructive in its consequences to almost the entire trade of the country." The reply of the Board is very reasonable and vouches much for the good sense of the Trustees. Thus :—

Ordered,——" That the Rev. Mr. Smith (the J.P. before whom the information alluded to in the foregoing communication have been lodged) be acquainted, that inasmuch as the penalty against *bleaching with lime* remains unrepealed, this Board are of opinion that he must use his own discretion in the enforcement of it in the present instance; and that the bleachers who have forwarded the foregoing memorial be informed of this our decision, and that they be at the same time acquainted, that if the law, as it stands at present, is likely to operate so injuriously to the trade, they ought to petition Parliament for an alteration in the Act, and the Board will attend to any application of theirs upon the subject."

The old law referred to, though intended for good, was certainly framed in a very mistaken spirit. Can anyone fancy a legislature settling the proper dye of a large calico-printing establishment in Manchester to-day? Yet such an act would scarcely be more absurd than the one under which Mr. Barklie was summoned before the magistrate.

It seems nigh impossible to enumerate all the good acts done by the Linen Board during its career from 1711 to 1828—an existence of 116 years. In Queen Anne's reign Parliament had enacted that a protective duty of sixpence per yard be imposed on all linens imported into Ireland. The Duke of Ormonde, the then Lord Deputy of Ireland, was so much heart and soul in the movement that he directed that hat-bands and scarfs of linen should be used at funerals—which custom still prevails in certain country districts even to-day. Then, too, one of the very first manifestoes of the Linen Board related to the breadths of the linen, as well as to the peculiar titles which should be given to each description of goods. These were arranged according to the lengths and widths of the webs. Linens 28 yards long and 21 inches broad were to be called "*Dungannons*"; those of the same length and 31 inches broad, "*Coleraines*"; same length and 36 inches broad, "*Lisburns*"; 41 inches broad and 20 yards long were to be sold as "*Lurgans*." All available machinery that could be brought to bear on the progress of the trade was forced into requisition, and the neighbourhood of Lurgan rapidly established for itself a name in the manufacture of fine linen, lawns, and cambrics, which gave that market a world-wide fame. The word cambric comes, of course, from Cambrai, diaper is cloth d'Ypres, and the word lawn is probably named after the town of Laon. The first piece of very fine cambric produced in the Lurgan district was woven by a weaver named Browne, who resided near Donaghcloney, and so great was the curiosity aroused that bleachers and drapers travelled from far and near to see it. In fact, Mr. Browne had a tin case made for the wonderful web, and in that form he carried it about for exhibition in several towns in the north of Ireland, and although the "set" was only a "sixteen hundred" all who saw the wondrous fabric were astonished at the fineness of its texture.

Prior to 1700 the export of linen goods from Ireland seems to have been of small dimensions, but now its growth was too salient to escape notice. We are told that although in 1689, the year of the accession of King William III, the export of linen barely reached £6,000, a few years later about 300,000 yards, valued at £12,000 were exported. In 1705 the total quantity shipped amounted to 520,000 yards, worth £24,000, and in 1720 the amount had increased to 2,400,000 yards valued at £100,000. Later on—in 1741—it reached £600,000; in 1770 £1,500,000, and in 1825 the declared value of Irish linen exported to Great Britain was £2,893,108. In 1720 it was the general custom to sell white as well as brown linens in the public market. However, when the art of bleaching became a separate branch of the trade, the practice of disposing of white linens at fairs and markets was discontinued.

There were other improvements which can be traced to the agency of the Linen Board. For more than a century prior to its establishment the mode of making up white as well as brown webs had in many cases been found most disreputable, and several appeals for reform in that department were made to the authorities by the more upright and honourable merchants and traders.

In order to remedy these evils, an Act was passed in 1719, under George I, authorising the Trustees to appoint fit and proper persons in all the market towns to examine linens offered for sale, and when found correct as to style of work and length and breadth, to stamp the same with their official seal. These inspectors were called "Seal Masters"; and on each piece, before admission to the "Hall" or market, the inspector of the district had to affix his seal. So if any buyer was deceived in quality he had a remedy against the "Seal Master" to whom he returned the piece found imperfect, and the official had to allow compensation. In his turn, too, the "Seal Master" could recover from the weaver. Several Bills to stamp out the abuse had been put in force, but still the frauds continued. Let the wisdom of Parliament—at the instance of the Linen Board—be exercised as it might for the prevention of abuses in the making up of linen for sale, ingenious weavers and cunning practising bleachers were always found capable of driving through the penal clauses of such Acts without much risk of being caught in the performance.

The Linen Riots

The export of Irish-made linens had annually progressed in amount till 1760, when, in consequence of the irregularities which had crept into the brown trade, a serious reaction took place, both in the demand for the home and foreign markets. As already stated, frauds to an enormous extent were discovered by the bleachers, and also by the purchasers of white goods. Inferior descriptions of linen, short measure, and damages throughout the cloth, formed grounds of general complaint. Yet despite all these abuses the weavers and drapers refused to be bound by any Parliamentary regulations. What is called the " lap yard "—viz., the outside fold which is first presented to the buyer was often of a superior description to the body of the web, and thus purchasers were fraudulently deceived as to the real value of the whole piece. The law passed fourteen years previously was ostensibly ignored. So now a new comprehensive Act was brought into force in 1762. How would it be received ? When the new regulations came into force, the utmost dissatisfaction was shown by the great mass of the sellers of goods. In fact, a minor rebellion was the result. The workers turned out against the law, and, having organised themselves in several districts, they set at defiance the powers of the Linen Board and Parliament itself.

Dromore, as one of the great centres of the trade, contained a vast number of linen weavers. These workers were among the earliest to war against the sealing of webs and the interference of seal masters. The leaders of the rebellious workers brought matters to a head on the 12th May, 1762, only a few weeks after the passing of the Act of Parliament, by issuing the following proclamation :—" This is to give notice to all gentlemen manufacturers and weavers to meet in a body, like valiant and honest men, at Lisburn on Tuesday next, that we may oppose *the imprudent and oppressive means* which are to be used against us by the merchants, and to bring them to reason by fair means, and, *if that will not do, other means will be used ;* and let us, like Demetrius and his craftsmen, stand valiantly up for our Diana, for our craft is in danger." The meeting so brought about was a very large one, but, after some hours' consultation, the men quietly dispersed without any disturbance. Next market day, however, matters were not so calm, for three or four hundred of the rebel weavers marched to and fro, armed with blackthorn sticks, and ready to create a row even "for the fun of fighting." He who would institute reforms must be prepared for martyrdom. John Kay, the Warrington watchmaker to whom Lancashire is indebted for the discovery of the flying shuttle, was long regarded by the weavers as their greatest enemy. It was likewise with Hargreaves whose spinning jenny was considered a demon in disguise so much by the cotton operatives that they wrecked his house. The Ulster weavers sought vengeance on John Williamson because of his advocacy of the 1762 Act. So hot was their vengeance that it was necessary to have Williamson's house at Lambeg protected by a company of soldiers.

The campaign against the sealing of linen webs having assumed a formidable aspect several of the members of the Linen Board were so frightened that they made little effort to enact its prohibitions. This inaction had its results in encouraging fraud, but the buyers of linen ceased to attend the markets except to buy small lots and the trade suffered great injury. However, the tide turned and by what seemed a trifling incident. Lord Hillsborough on a certain day attended the market held in his own town and set the example personally of inspecting and sealing the goods offered for sale. It seemed of little consequence, this action, yet it had enormous after effects. Almost immediately the spirit of conciliation spread abroad, and ultimately the duties of the sealing master were equally appreciated by the weaver, the draper, and the bleacher alike. Yea, a few months later the weavers were expressing their gratitude to the Linen Board for bringing in the 1762 Act. Withal, it is rather to be regretted that while the weavers were grateful to Mr. Williamson, his colleagues of the Linen Board singled him out a few years later for a malicious insult by refusing him the " white seal " when every other bleacher in the Kingdom had been furnished with one. Mr. Williamson was a public-spirited gentleman who had spared neither time nor expense in carrying out his plans for the practical advancement of the linen trade, so we can well understand that so indignant was he at this insult that he gave up his bleaching concern at Lambeg, and determined to take up his residence in London.

Linen Outside Ulster

It might be supposed from my neglect to mention the rest of Ireland outside Ulster that the linen business during the eighteenth century was confined to the Northern Province, but that was not so. Before the introduction of spinning machinery the linen business was spread over the Green Isle. In particular the manufacture of the necessary linen yarn was carried on in all four provinces. Thus it was stated that " a considerable portion of the yarn made and sold in the province of Connaught was carried by dealers into Ulster for the purpose of manufacture." Much yarn was also spun in Leitrim and Donegal. Plain linens made in the neighbourhood and town of Drogheda were generally coarse, from 24 to 30 inches wide, and the ticken, which formed a large proportion of the make, was from 26 to 28 inches wide. In the other districts of Louth a much finer class of goods ranging up to sixteen hundreds was also made. King's County was famed for dowlas, and Cork for its heavy twills and stripes. Clare had its production of coarse fabrics, from eight to ten hundreds, and in Tipperary there was a good deal of business done in three-quarter and yard-wide linens. The linen weavers of Mayo, Sligo, and Galway were principally engaged in working a very stout fabric of seven-eighths wide, the sets of which were from eight to eleven hundreds. Leinster, Munster, and Connaught had each its representatives on the Linen Board.

Yet there was, notwithstanding, a very noticeable tendency for the manufacture to concentrate in Ulster and around Belfast. In old times the Linen Hall, in Dublin was the mart to which all the merchants repaired with the cases of bleached linens finished and ready for sale. There the English traders attended and made their purchases. In those days the means of communication into the country were few, and the system of one great central market gratified all parties admirably. The development of new roads throughout Ireland and the rising steam fleet of Belfast eventually broke up the monopoly, and the Irish merchants found their way across the Channel to London and Manchester where they appointed agents to sell their goods instead of troubling the buyers to come to Dublin. So in course of time the Dublin Linen Hall became less frequented and the Belfast Linen Hall took precedence.

THE OLD LINEN MARKETS

According to *Bradshaw's Directory*, 1819:—"The Belfast White Linen Hall is a large hollow square, erected by subscription on the site of Castle Gardens in the year 1783, *with intent of removing the sales of* *white linen from Dublin all to the heart of the manufacture.*" Quite so. *Tempora mutantur, nos et mutamur in illis.* The site of the Belfast White Linen Hall has long ago been covered by its palatial Municipal City Hall, while a small knot of dealers gathered on the sidewalk at noon daily in Bedford Street is the sole reminder of the old glories of the linen market. *Sic transit gloria.*

Simultaneous with the Belfast White Linen Hall was the Brown Linen Hall in Donegal Street, enclosed with high walls and arched shades for the accommodation of buyers in bad weather. Only 38 inch brown linens, 16°° to 22°° were there sold, and the weekly turnover averaged £4,000. There were "rich manufacturers" who brought ten to forty pieces each week. These so-called "manufacturers" bought yarn and gave it to bleachers who had one or two looms in their homes, and who returned it in webs. Other weavers brought their webs direct to the market. On the average 400 manufacturers and sixty buyers attended each market. The White Linen Hall—long ago demolished to give place to Belfast's City Hall—was erected by public subscription, and in it a trade in white goods was gradually established, but as bleachers were the principal merchants the export trade in white goods continued to be carried on chiefly at the bleach-greens or the country town nearest. In this connection it is easy to see how those towns, now celebrated for their webs, arose in commercial rank and importance, through the great impulse given to general business by the weekly circulation of the sums paid to weavers and drapers. For the twelve months ending 31st December, 1900, the number of drapers attending the markets of the following six counties, and the sums paid away for linen in the several towns of each were as follows:—

	Drapers.	Sums Paid.
		£
Armagh . .	200	450,000
Antrim . .	156	400,000
Down . .	150	350,000
Derry . .	130	280,000
Tyrone . .	80	190,000
Monaghan . .	50	160,000

Beside the business done in the purchase of brown linens, a large trade was carried on at each market in the sale of linen yarn. During the busy seasons from £300 to £500 was paid in the course of one day by the buyers of linen yarns, and all these sums went into the pockets of the neighbouring farmers or their connections.

English Linen Trade

Though there is much difficulty in gleaning any information regarding the linen manufacture of England during the eighteenth century there can be no doubt that it was carried on in various centres, and it is equally patent the quantities produced were almost solely for home use. The utilisation of coarse linens by farm labourers and other workers was very general as well for inside clothing as outer garments. It has been estimated that at one period—immediately preceding the introduction of raw cotton into England—the annual production of linens was about 14,000,000 yards, and the import from other countries exceeded that figure. As it is, to-day there are in England few linen factories, and these seem engaged almost entirely in making drill, sail-cloth, canvas, and the coarser varieties of textiles. A few figures will explain this trade. Thus in 1782 there was exported to England from Ireland 15,212,968 yards of linen cloth, valued at 16d. a yard, and 3,937,700 lb. of linen yarn set down at 1s. a lb. For the same twelve months the English merchants imported into Ireland goods to the value of £2,320,450. Among these were lots of canvas at 14d. per yard, flax seed at 60s. per hogshead, printed calico at 5s., and white calico at 4s. a yard. These articles of clothing material were then considered a great luxury, not only in Ireland but in the great sister isle, though only the wealthier classes were able to purchase them.

THE SCOTCH TRADE

Ireland's commercial transactions with Scotland were miserably small in the last quarter of the eighteenth century. The value of all the imports from north of the Tweed into Ireland in 1782 only amounted to £307,100, while the Irish exports—consisting partly of provisions, live stock, and breadstuffs, as well as linen and yarn—were on a still smaller scale, being less than half the imports. There were at that time about 50,000 hands employed at the linen looms in various parts of Scotland; but the small quantities of fine goods taken for home consumption were nearly all imported from Ireland and the Continent. Before 1782—in fact in 1756—a society of Weavers had been constituted in Kinross which, on the pattern of the old Guild idea, tried to regulate laws of labour, and also supplied seed on credit as well as advancing the money to buy the yarn often. It was not, however, until 1790 that water-power for working the looms was introduced in Scotland. Then strangely enough, while steam spinning and weaving was in vogue in Scotland in 1836, it did not come into general use in Ireland until a score of years later. The change created by the greater development of the cotton and woollen industries in Great Britain was marvellous. It was true that one large section of the linen trade was still urged onward by the energy of leading capitalists, but the vast proportion of the enterprise of York and Lancaster with Ayr and Lanark, was turned to the cotton trade, and at length these shires of Great Britain became the wonder of the world, and cotton goods were manufactured there to an extent of which its early patrons never had the most distant idea. It seemed, too, that even in Ireland linen would give place to cotton. The changes effected by the introduction of cotton into Belfast and the district were indeed very remarkable. Previous to the advent of the Oriental fibre there were 500 linen looms regularly employed in Belfast. Thirty-four years afterwards, we find that the number of such looms had fallen to about half a dozen, and those employed at the cotton trade were about 900. And now to-day there are in Ireland 37,292 power linen looms! Truly, the flax-spinning business has come through a romantic series of fluctuations of fortune.

Linen Bounties

So far we have described mainly the foundations of the linen industry during the eighteenth century, and the scope of the present work being necessarily limited, there must be a condensation of the facts relative to the development of the trade during the nineteenth century. As in the sister industry, cotton, the introduction of the fly-shuttle, the great invention of Kay of Bolton, gave great impetus to weaving. Under the old system of throwing the weft from selvage to selvage of the web, two persons were required to work a very broad linen fabric—the one "pitching" the shuttle from the left side of the loom and the other from the right. Now, however, all that was dispensed with, and simplicity with alacrity reigned instead. Moreover, there were other encouraging factors. The average area under flax in Ireland was (1810–16) about 80,000 acres each year, and very little, if any, raw flax was imported About 1,000 tons or so of flax was yearly exported to Great Britain. Flax-spinning mills driven by water power were, in and after 1805, started in various places in Ulster, and a bounty of 30s. per spindle was given to encourage the erection of these mills. One of the largest of them belonged to Messrs. Joseph Nicholson & Son, of Bessbrook. In 1816 that mill contained for line spinning five spreading tables with drawing heads, three second draws or doublers, three roving heads with ten spindles; and of tow-preparing machinery it had six carding machines, and two roving heads with ten spindles. Of flax-spinning machinery it had twenty-two spinning frames of thirty-two spindles each, and two of twenty-four spindles; and of tow-spinning machinery four spinning frames of thirty-two spindles each, and six of twenty-four spindles. In all 1,024 spindles were at work.

During the period of seven years in which this bounty of 30s. per spindle was given—namely from 1805 to 1811—twelve spinning mills were erected in Ulster, having a total of 6,369 spindles. These mills were scattered over the counties of Antrim, Armagh, Down, Donegal, and Tyrone. The principle and practice of "Bounties" appear strange to a merchant of the present day. The following extract from the Parliamentary grant during 1821 shows to what extent this encouragement was applied:—

The sum of £2,000 for one year to encourage the raising of sufficient quantities of hemp and flax in this country	£2,000
The further sum of £2,000 for one year, for the encouragement of the hempen and flaxen manufactures in the provinces of Leinster, Munster and Connaught	2,000
The further sum of £7,250 for one year, etc., to encourage the growth of flax in this kingdom . .	7,250

And the further sum of £10,350 for one year, etc , to be by the said Trustees applied in such manner as shall appear to them to be most conducive to promote and encourage the said manufacture, the said sum to be in place of a like sum paid to them out of the produce of the duties on teas and coffee. . .	10,350
Total	£21,600

The sum is in old Irish currency, and is equal to about £20,000 modern British currency. One great object of the bounty in early days was to encourage specially the manufacture of sail-cloth, canvas, and duck made from mill-spun yarn. It amounted to 2d. per yard for the better qualities and 1½d. per yard for the poorer qualities. The manufacturers were informed that the articles meant to be encouraged were those suitable for the Navy, the object being to have in the country a manufacture which would render it independent of foreign supply in an article of primary importance. Strangely enough despite this lavish encouragement the making of sail-cloth, canvas, and the coarser flax fabrics has migrated very largely from Ireland to Scotland within recent years.

Adam Smith has laid it down that "the effect of bounties like that of all such expedients of the mercantile system, can only force the trade of a country into a channel much less advantageous than that in which it would naturally run of its own accord." In reality, however, as regards the fostering of the linen trade the system of bounties had its good—as well as its evil—side. It is singular to read that at a meeting of linen manufacturers held at Aberdeen in 1820 the following resolution was passed with acclamation :—" It is the decided conviction of this meeting, founded upon long practical experience, that the Bounty which has now for nearly seventy years been granted upon the exportation of British and Irish linens is of the utmost vital importance to the preservation of that valuable branch of trade; and that without such bounty it would be quite impossible for the British and Irish manufacturers to compete in foreign markets with the linen fabrics of the continent, where the price of raw material, as well as labour, is at all times extremely low." The fourth resolution requested Parliament to have the bounties on the exportation of linen rendered *perpetual*—a measure, in the opinion of the meeting, *essentially requisite to the stability and permanency*." Quite so. And to-day the linen industry is much more prosperous than ever it was in the time of these bounties.

Certainly it is a most singular fact that perhaps the most backward of the Irish manufactures now is the very one that received most money for encouragement during the ten years previous to 1828—namely, sail-cloth and canvas.

Evils of Bounties

The system of bounties in its train brought evils, and about this time two practices pursued by the weavers attracted much notice among the merchants. One of these was the custom of putting paste on the brown linens so as to give them an artificial appearance of weight and strength. The other custom was the rubbing or calendering of linen to such extent as to injure its durability, especially at the selvage. In fact, this rubbing gave the piece a much finer and richer appearance than it otherwise would have had, and thus deceived the eye of the buyer. These two systems of trickery were thoroughly exposed by the merchants at various meetings and strict measures were adopted to remedy these faults and keep up the reputation of the manufacturers. In addition to these frauds the farmers were being made the victims of deception by dealers in flax seed. It is some consolation that few instances of such fraud occur nowadays. The bounties which had been given for the encouragement of the linen manufacture in Ireland, and which lasted about 130 years, began to diminish from January, 1825—being reduced to £10,000 next year—and were entirely withdrawn in 1828. In that year, also, the Board of Trustees of the linen and hempen trade was dissolved. It had begun to be felt by those engaged in the linen trade that the Board's action tended to cramp rather than to encourage the trade. This acknowledgment is displayed by the following letter to the Linen Board from Mr. Cory, the Secretary :—

> That the prosperity of the linen manufacture of Ireland has been greatly advanced by the wisdom of the laws which have governed it cannot be denied, but there is a popular opinion now abroad in which I feel that I participate——that, after a certain point of prosperity has been attained, the less any manufacture is encumbered with legislative regulations the better.

At this meeting it was decided to continue the duties of the Board till dissolved by Act of Parliament. They were not long kept in suspense. A few months later intimation was received to the effect that no grant would be proposed for the year 1828, and so the word " Finis " came to be written with regard to the Linen Board.

From its dissolution in 1827 until the establishment of the Flax Improvement Society of Ireland in 1841—a period of thirteen years—the production and manufacture of the flax plant were left without almost any other guardian than the intelligence of the parties engaged in their conduct and management for their own private interests. Some few of the Provincial Agricultural Societies, no doubt, awarded premiums for good flax, but merely as a portion of the "farmer's crop," and not in the broad light of a national production and manufacture. The Royal Dublin Society also offered for competition, at their triennial exhibitions, prizes for the best specimens of Irish linens of different qualities and classes. There appears, however, to have been an evident want of some substitute for the great central Linen Board during this period—some society to watch over and protect, in a national spirit, the general interests of the flax-growing and manufacturing community; to introduce, after proper trial, improved modes of operation; and to collect statistics on which to base calculations and confirm facts. It certainly does seem a pity that so many years were allowed to elapse before this void was filled up; years during which numerous important changes took place in the manufacturing process, more especially in the preparation of the fibre. During this period, the old system of hand-scutching and hand-spinning at home, and the selling of linens in the markets by weavers were quite revolutionised.

Factory System Introduced

One cannot attempt in a single sentence to encompass the great transformation in flax-spinning about the year 1828 or so. Prior to that time linen yarn in Ireland was spun—mainly in the cottages and farmhouses—only by the hand on the old-fashioned spinning-wheel. But the number of scutching mills in the country was increasing, and the flax prepared by them commanded such preference that hand labour in this branch was much less in vogue. For spinning the yarn very perfect machinery, driven by the powerful steam engine was also introduced ; and this so completely outrivalled in economy and regularity the hand-spun productions, that in all—except a few of the very fine—numbers the handspun yarn was speedily driven out of the market. In the year 1828 Messrs. Mulholland's cotton mill was burned to the ground. They at once, with the enterprise that distinguished the family, decided to rebuild it as a flax-spinning mill. That mill started work in 1830 in Henry Street, Belfast. Part of those same buildings still contain the offices of the monster York Street Flax Spinning Company, Ltd., and for some years the Mulhollands enjoyed almost a monopoly, and consequently attracted business. As the Messrs. Murland of Castlewellan dispute priority with the York Street founders as to which party first erected flax-spinning machinery in Ireland, it is sufficient for us that both started their mills in the same year. And now began the real decline of hand-loom weaving, for the vigorous self-reliant weavers began to drift from the lands into the towns where employment was regular and more sure. So by 1853—twenty-five years after—there were in Ireland eighty flax-spinning mills yielding linen yarn, containing 500,000 spindles, and producing, if worked ten hours daily, fully 9,000,000 of bundles of yarn per year, worth about £2,250,000 at a moderate valuation.

It is true that the beginning of the evolution of machine-spinning had taken place forty years earlier in England, machinery having been invented by John Kendrew and Thos. Porthouse at Darlington in 1787. Their spinning frames were rude and suited only for coarse yarns, but Mr. John Marshall of Leeds, having taken up the invention, improved it, and also developed the industry largely. Machine-spinning spread into Scotland, where a mill was erected near Glamis in 1790.

But though Ireland was the last to begin, not many years elapsed ere it was abreast of England and Scotland. In 1850 there was about an equal number of spindles in each country, yet a little later, in 1856, England attained its maximum with 440,000. Since that time its spindles had decreased until now its linen trade seems to be merely existent, with less than 50,000 spindles. Even the Messrs. Marshall had found it necessary to wind up and close their once famous mills in Leeds and transfer their business to the United States, where their mills now form part of the Linen Thread Company or Combine. Scotland reached its maximum in 1871 with 317,000 spindles—now it has 160,000 spindles—while Ireland's share has gone on increasing by a larger number than the other two have lost. In 1875 Ireland had 906,000 spindles in operation, and a few years ago 935,411 spindles belonging to some fifty different companies—seventeen of them in Belfast, one in Cork, and the others scattered throughout Ulster.

One of the reasons of this great displacement in favour of Ireland was because it had practically this one textile industry only, whereas England and Scotland had others which had allowed of a higher profit and the payment of a higher scale of wages. But it should be realised that the production per individual spindle is much greater to-day than it was twenty years or so ago.

Royal Flax Society

We have seen how after an interim the Flax Improvement Society came into existence—succeeding the Irish Linen Board—in 1841, and not much is left us as to its success or want of it. At any rate, it was succeeded in 1841 by the Royal Flax Society of Ireland which, besides noble patronage, had the tangible support of £1,000 yearly from the Irish Viceroy. Itinerant instructors were provided to give advice gratis to all growers, and in connection with the visit of Queen Victoria in 1849 a linen exhibition was promoted. After an existence of eighteen years this Royal Society in its turn collapsed, though its direct successor, the Flax Supply Association for the improvement of the culture of flax in Ireland came into being in 1867 and still continues vigorous and useful.

Certainly there can be no doubt that in its era the Royal Flax Society did much good work. Very enthusiastically was worked up the scheme of the establishment of new markets for the sale of flax, especially in the south and west of Ireland. This Society did not, however, do much, if anything, in relation to the old linen markets, as they for many years had been declining. I have already explained how the system of selling in the markets by the weavers was much altered between 1826 and 1846. The change was similar to that effected about the same time in the Cloth Halls of Leeds, Manchester, and other places in England, and followed—as a necessary consequence—the introduction of large mills for spinning the yarn. The change mainly consisted in the gradual disappearance of the small manufacturers, and the substitution in their stead of a class of large manufacturing capitalists, some of whom combined the spinning of yarn with the making of the cloth. This change in the economy of the linen trade was certainly a great benefit, as it ensured the application of a large amount of skill and capital where both were previously rather deficient, and thus contributed to promote that evenness of make and regularity of production so much desired in all manufactures.

CHAPTER IV

THE LINEN TRADE AS IT IS

HAVING devoted so much attention to the foundation and history of the linen trade it is now opportune that we should halt for a brief spell to consider its present position as a whole in the textile world, its relation to the other textiles and its magnitude in general. The manufacture of linen is carried on extensively in only two districts of the United Kingdom, namely, in the North of Ireland, and, to a less degree, in the East of Scotland. In both districts the industry has attained very large proportions, and "Irish" and "Scotch" linen have now a world-wide reputation. The linen industry occupies the third place in importance in our textile industries, the total value of linen manufactures exported from the United Kingdom for the year 1913 was £8,247,571, while for the previous year (1912) it was £8,416,840, and for 1911 £7,841,667.

Regarding the capital employed in the Irish linen trade alone, Sir William Crawford, who can from his vast knowledge and experience claim to be an authority, gives us some idea. In an exhaustive paper read before the Royal Society of Arts in London he put it that there are—

948,000 spindles at average price £5 each	£4,740,000
37,000 power looms at £50 average each .	1,850,000
Bleaching, Printing, and Finishing Works together estimated at . .	750,000
Total .	£7,340,000

Photo by Welch

A TYPICAL LINEN MILL, SION MILLS, CO. TYRONE

But this £7,340,000 represents plant alone, so in addition we must include the stocks of raw material and of goods in the process of manufacture and in a finished state. These alone would be value for a further £5,000,000 or £6,000,000. Then there is additional the amount of capital employed in giving credit to buyers, and whether this be in the form of discountable bills or of open accounts, capital to the extent of £2,000,000 is required to do it.

The grand total of capital employed in the Irish linen trade would thus amount to at least £14,500,000. In fact, we might take it that for the linen trade of the United Kingdom the capital is probably £16,500,000.

About £75 is spent in turning £100 of flax into yarn, another £75 in turning that yarn into brown linen, and about £50 in turning that brown linen into white goods ready for the market.

Thus on £100 worth of flax about £200 is spent, chiefly in wages, and the finished product is worth £300.

Wages and Employment

Similarly we might estimate the amount paid in wages to the operatives as follows :—67,027 men, women, and young persons, at an average wage of 15s. per week, £2,614,053 ; bleachers, printers, and finishers, £500,000 ; embroiderers, hemstitchers, and warehouse hands, including lappers, ornamenters, and boxmakers, £400,000 ; hand-loom weavers, £55,000. Besides all these there are clerks, managers, and other officials whose salaries would amount to £250,000 ; and if 5 per cent. on capital, £725,000, be included it would show a grand total of £4,544,053. It is nigh impossible to accept this figure except in its narrowest sense for from the aspect of employment the benefits from the linen industry in Ireland are very much widespread indeed. The raw material—*i.e.*, as flax or yarn—is transported to the mills by railways and carrying companies, which again and again transport it from the spinning mills to the weaving factories, from the factories to the bleach greens, and from the latter to the distributors or making-up factories, and finally to the quays for shipment. Much of the flax is imported to Ireland by Irish-owned ships. When landed at Belfast it forms a very important part in the mercantile transactions of the port, and its warehousing and handling employ a large amount of labour. Then there is its transport to the mills and from the mills to the factories, for many of the manufacturers have to supply their requirements from the spinners, as not all the establishments combine both processes of spinning and weaving. What Sir C. W. Macara, President of the Master Cotton Spinners' Association, described with regard to that trade applies similarly concerning the linen industry and its enormous influence on employment.

The linen operatives engaged in spinning and weaving probably number 73,000. The number employed in subsidiary industries and employments associated with linen, already enumerated, is much more difficult to calculate, but it will probably amount to another 73,000. Allow two dependents only to each worker (there being a large number of young people employed) and we get a population of 292,000 people influenced by the industry in Ireland. We might extend our estimate even further to include the great machine-making and engineering establishments, which are largely engaged in repairs, renewals, and extensions both at home and abroad of the linen and subsidiary industries. All of these represent a further section of the population. In fact, in any dislocation of the linen industry its serious effects on trade and employment generally in the North of Ireland would be widespread. It may be enunciated plainly that besides the large sum of money paid to the farmers for flax, the linen trade is the means of distributing in the province of Ulster more than £6,000,000 annually, and half, if not more, of it is drawn from foreign countries, as much the greater portion of Irish linen products is sold outside of the United Kingdom.

What the Output Means

It is only in a small portion of Ulster that linen is made. That is, perhaps, as curious a fact as any associated with the manufacture—the exceedingly small area within which it is circumscribed. With the exception of the collateral cotton trade it is doubtful if there is a business of such magnitude and such importance confined within so small a space. What the importance of this spot, which on the map of Ireland in an ordinary school atlas may be almost hidden by a penny piece, is, may be understood by the following fact:—In one year alone the yarn spun by the countless mills in this district was estimated to measure about 644,000,000 miles. To grasp what this means is to realise a gigantic ball of yarn, which, unwound to its single thread, would encircle the world 25,000 times. In a three-ply cord the same yarn would reach from the earth to the sun and back again. Or should we desire to pay a visit to the man in the moon, our big ball of yarn would give us a pathway, 380 threads wide, extending the full length between our planet and his.

And what of the cloth which last year's output of yarn might be woven into? It represents a web containing about 156,000,000 yards. We might unroll this Gargantuan web and make a path three feet wide, and on its snowy whiteness laid flat, we would be able to make a triumphal tour completely around old Mother Earth at the equator. We might even make a big tent of the big web manufactured by Ulster's mills, and what a wonderful tent it would be?—such as would amaze even Haroun al Raschid. With the dome of St. Paul's for its centre support, this glorious canopy would cover 500 acres and stretch as far out over London as twelve and a half miles on all sides.

DESTINATION OF LINEN MANUFACTURES

The consideration of the question of what becomes of the linen so greatly manufactured in Ireland is interesting, and the Board of Trade with other returns give us the information to some extent. We know that for last year (1913) the total value of all linen exported was £8,247,571—and of this Ireland supplied four-fifths—but the figures relating to the respective destinations are not yet accessible. The United States, in 1909 and 1910, took more than one-half of the total exports. In 1911, their purchases did not reach this level, amounting to only 47·6 per cent., while those of Foreign Countries and British Possessions were increased, the former to 28·3 and the latter to 24·1 per cent. of the total.

Undoubtedly Uncle Jonathan is our best customer, and of the linen used by him fully 70 per cent. comes from Ulster. It is an interesting sidelight on his patronage that, during 1910, 1911 and 1912, Uncle Jonathan paid us for handkerchiefs alone £527,291, £517,500, and £438,750. Of the Foreign Countries Germany during 1911 patronised us for linen value £293,672; Brazil for £258,852, and Japan £154,075. Naturally the custom of the Colonies is large, Australia's purchase of linen for the same year (1911) being £769,818, while Canada took £605,330, and India helped us, with £202,109 for linen.

A glance at the following table will show to what extent the various portions of the world patronise the United Kingdom for linen :—

	United States of America.	Foreign Countries.	British Possessions, etc.	Total.
	£	£	£	£
1895 .	2,857,691	1,709,466	782,868	5,351,025
1907 .	3,876,824	1,954,718	1,514,197	7,345,740
1908 .	2,806,296	1,675,602	1,317,300	5,799,198
1909 .	4,203,037	1,802,580	1,539,544	7,545,161
1910 .	4,221,170	2,228,926	1,830,590	7 999 994
1911 .	3,736,464	2,217,625	1,887,578	7,841,668
1895 .	53·4 per cent.	32·0 per cent.	14·6 per cent.	
1907 .	52·8 ,,	26·6 ,,	20·6 ,,	
1908 .	48·4 ,,	28·9 ,,	22·7 ,,	
1909 .	55·7 ,,	23·9 ,,	20·4 ,,	
1910 .	51·0 ,,	26·9 ,,	22·1 ,,	
1911 .	47·6 ,,	28·3 ,,	24·1 ,,	

FOREIGN LINEN MANUFACTURES

In conclusion, lest the reader might absorb the idea that linen is produced only in Ireland, and to less extent in Scotland, it is well to point out that there are foreign linen manufacturers who actually send linen into the United Kingdom. These imports, which in 1910 amounted for the first time to the value of one million sterling, increased in 1911 by some 4 per cent., the value of the same reshipped from the United Kingdom being a trifle less than in 1910. Upwards of 90 per cent. of the imports are retained for use in these islands, and it seems paradoxical that Belfast is itself a good customer for the linen imported. During 1913 the linen imported into the United Kingdom was 17,406,699 yards valued at £1,194,069, compared with 14,924,172 yards valued at £1,126,440 for 1912. The chief sources of these imports was (in 1911) Belgium, £539,495; Germany, £293,762; France, £80,284; Japan, £22,854; and Switzerland, £15,795.

CHAPTER V

THE RAW MATERIAL—FLAX GROWING

To explain the various processes by which a handkerchief, or for that matter a damask tablecloth, is produced we must begin in the manner the crab progresses—by moving backwards. In this way we find ourselves in imagination in the centre of a field of growing flax, known to the botanist as *Linum usitatissimum*. It is brilliant July weather, and the noonday sun beams down on a scene of transcendent beauty; for if you have never seen an Ulster flax field in blossom you have missed one of Nature's prettiest panoramas. The field in the distance appears a mass of soft and elegant green, undulating in long waves when under the pressure of the breeze. Approaching near all around us the modest flax plant, with its exquisite long green stems crowned with daintily small, bright blue flowers, reaches knee height. At this stage there is no crop the agriculturist produces that can equal flax for ornamental purposes. It is as picturesque as a plot of poppy-speckled corn, although it has not been so well worked either in poetry or painting. Three weeks hence the blossoms will have given place to the seed pods—the linseed of commerce—but it is the sinewy stems we have to do with.

However, we progress just a little too fast, so must hitch back just a moment to think how these stems and flowers came into being. Naturally they came from seed—and in ensuring the best classes of seed both the Flax Supply Association and the Government Department of Agriculture deserve thanks for their energetic help in assisting the grower. The great difference which exists between flax and cotton culture is that the peculiar nature of the Oriental fibre requires a warm sun and a mild climate to bring it to perfection. Flax will grow in almost any temperature, and on any description of land. Fair crops have been raised off light soils as well as from stiff clays. The sheltered vales and low-lying grounds of the plains, the sandy subsoils of the mountain sides, or the peaty bottoms of old bogs have been alternately used as flax fields. However, no variety of land produces such ample crops of the finer qualities of flax as the nice dry loam, not too light and yet not of a clayey nature. The land should be drained and free from weed. Much damp injures the crop and a quantity of noxious plants, rising with the flax will seriously check its perfect development. Deepness of soil is an essential requisite for flax-growing, for of all annuals none strike so deep into the earth as the roots of this plant.

In the counties of Down, Antrim, Armagh, and Tyrone many of the farmers have arrived at high perfection in flax-growing. The yield per acre from these counties during 1912 was phenomenal. In the entire annals of the Flax Supply Association, which now embrace forty-six years in the history of flax culture, there is nothing to equal the yield recorded in 1912, viz., 42·11 stones per acre. In 1901, or just eleven years previously, there were almost 37 stones per acre, and that was regarded as an exceedingly productive year. In the detailed record of the scutch mill returns for the counties of Antrim, Donegal, and Down there are some exceedingly prolific yields, 60 and 70 stone per acre being not uncommon. When we know that the average price obtained was 6s. 6d. per stone we see that this works out at £22 15s., so we may conjecture that there was ample margin of profit to make flax-growing actually fascinating for the farmer. However, too often the profits of the flax crop have been overrated and much disappointment caused thereby among growers who have tried the cultivation with only moderate success. With ordinary care a fair profit may always be expected, while occasionally a larger sum may be realised than by any farmer's crop grown in Europe. With respect to seed the very best and purest should always be procured, and as both the Flax Supply Association and the Government Department are always willing to give their help in guiding the farmer to securing the very best, the fault is his own if he is so foolish as to run any risk by purchasing job lots of seed, and for the sake of a present saving of a few shillings endangering the eventual loss of as many pounds.

It must not be forgotten that flax cannot be raised year after year from the self-same soil. In Belgium it is generally sown in rotation after oats, but Irish growers favour sowing after wheat. In this connection the rotation followed by an expert is to break up lea ground in oats, followed next year by potatoes and turnips, etc. Then fourth year wheat and fifth year flax. Of course opinions differ and this rotation may be varied at discretion. The general custom is to plough the wheat stubble in March so as to get a little of the frost. In April then the soil is fit for thorough harrowing and picked clear of weed preparatory to being sown with flax seed at the rate of a Riga barrel, or 3½ bushels, the Irish acre, *i.e.*, about 2¾ bushels of seed per English or statute acre. After the seed is sown a light roller is passed over the field to make the ground as even and flat as possible and so ensure uniformity of length in the stems of the plant when at maturity. It is always better to sow rather a full quantity, except when intended to garner the seed for reproduction. When put in sparingly the seeds produce stronger plants, having great branching tops, loaded with bolls (or seed capsules), but the quality of the fibre is generally deteriorated and always coarser. Depth of tillage is important also, since it is essential that the roots penetrate deeply to get the nourishment for the fibre.

When the seed has been sown it must be carefully watched to prevent weeds gaining mastery and injuring the crop, so weeding is done when the plant is about five or six inches high. We will now imagine the flax field in full growth. Yea, the flowering stage has given place to the seed pods. Along some fine morning will come a band of happy harvesters, lads and lassies, who will proceed in an extended line, pulling up the stems with their naked hands right and left as they go. There is an exact moment for pulling the flax, and the common rule is to allow two-thirds of the stalk to become yellow, and not to allow time for the seed capsules to become more than slightly tinged with brown. The Société Linière of Brussels opines that "it has been proved that when flax is pulled between the falling of the flower and the formation of the seed the fibre is finer and more solid than at any other time. So that, unless it is wished to sacrifice the quality of the flax to obtain seed, the former must not await the full maturity of the latter."

In our case we wish to trace out the progress of the plant intended chiefly for the production of the linen fibre. We have seen it pulled, with the long and short stems kept as distinct as possible but the lower ends kept even. The handfuls are next handed to the "ripplers," who pass the tops of the plants through a machine called the ripple—a kind of large comb. The two ripplers sit opposite each other, with a large sheet below on the ground. Then the bundles of flax, after the seed is taken off by the instrument, is neatly tied with rubles and formed into stooks through which the air passes freely for three or four days. The seed is reserved for feeding cattle and horses.

It may be stated that in Ireland during 1912 the acreage under flax was 54,917, of which 54,446 acres were in Ulster, 313 acres in Munster, only 47 acres in Leinster, and 111 acres in Connaught. For 1911 the entire acreage under flax in Ireland was 66,618, and for 1910 and 1909 45,974 and 38,110 acres respectively.

Conditions in Russia

During the last fifty years the cultivation of flax has gradually declined in "John Bull's Other Island" while it has increased abroad. Thus in Russia it increased from 3,216,205 acres in 1910 to 3,429,121 acres in 1911. In fact, Russia now supplies over 75 per cent. of the total flax produced in Europe—the reason being the cheapness of labour and the large areas of land suitable for the growth of this crop being available.

Yet of flax-producing countries the land of the Czar is the one of which least is known, because, owing to its extreme type of Continental weather, an uncertainty always exists as to the result of the crop. Long spells of drought on the one hand and of rain on the other often injure the flax. The retting operations during the autumn are liable to interruption from the on-coming of an early winter, and the prospects of a good crop have sometimes been completely nullified owing to the prevalence of unfavourable climatic conditions during the retting process. It is by no means uncommon in Russia for flax to be "snowed"—*i.e.*, covered with snow while spread on the fields, and it has often to remain in this state until the snow melts in spring. Retting operations, too, have often to be put off until the spring so as to secure more favourable weather. The Russian flax markets depend for their supplies on the existence of sledge roads, which are often impracticable, and on river communication which, unfortunately, sometimes closes early in the season. The closing of the Baltic navigation in winter is also a factor which is of serious moment to the export trader.

CHAPTER VI

PREPARING THE FLAX

THERE is a wide difference between the flax plant as it is just pulled from the soil and its appearance in the finished stage as we know it in the snowy damask tablecloth or the dainty cambric handkerchief so treasured by the Countess who desires to represent *le dernier cri* in stately court circles. The flax bundle must now undergo its first real stage in transformation.

THE PROCESS OF RETTING

This stage is one of the most particular and decidedly the most disagreeable to be encountered in the management of flax. It is known in the Ulster dialect as "retting," and consists of subjecting the flax stalks to a putrefactive ferment lasting about a fortnight, by which the woody straw of the stem softens and disunites from the former stringy fibre. The usual custom is to have what are known in the vernacular as "lint-holes," cut near a stream, about six to twelve feet broad and three or four feet deep, the lengths various, the pool or pools being so arranged as to admit water from the stream at one end when required—which would be generally some weeks before the flax is ready for immersion. The bundles of flax are placed in this water in one layer, rather sloped, while the top is covered with rushes, straw, or rough sods, and some stones put on last to keep all firmly under the water. In Flanders much more care is usually taken than in Ireland, as the flax is generally higher priced and admits of increased expenditure in its preparation. The

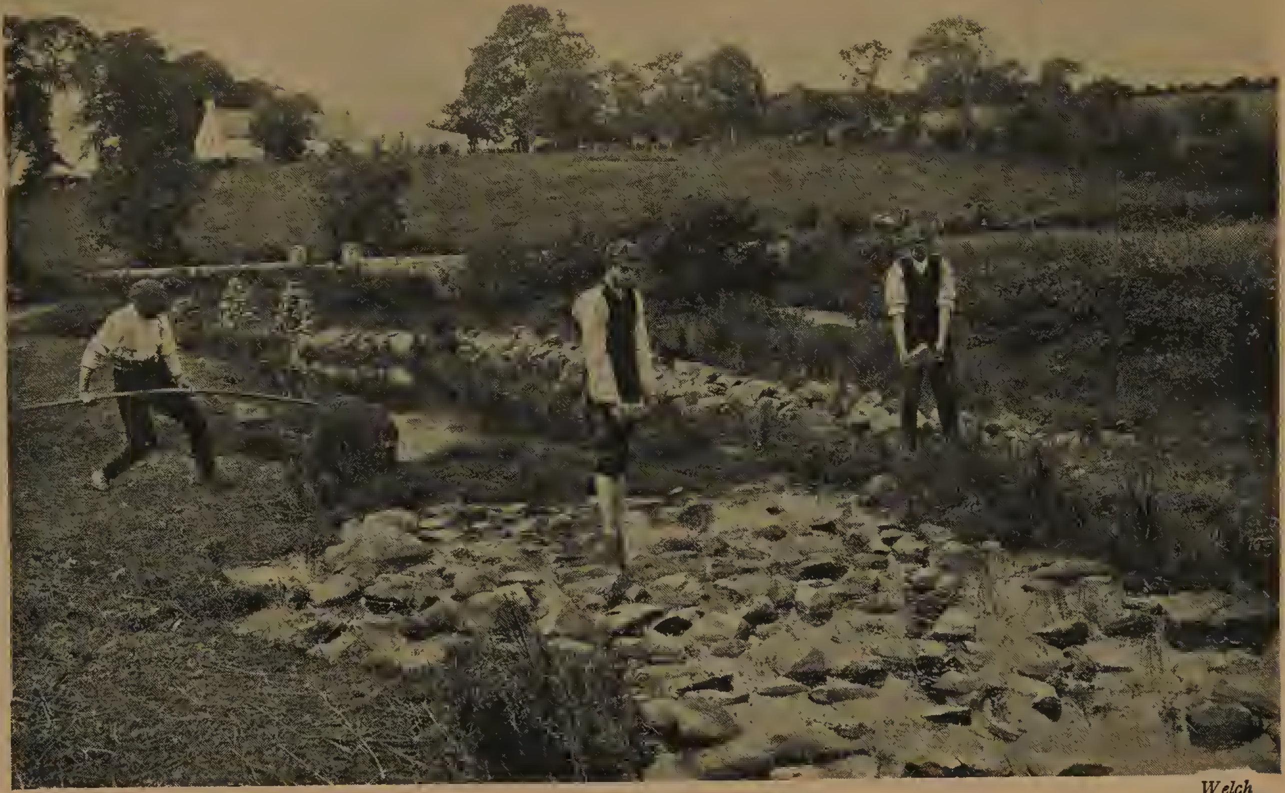


Photo by Welch

IMMERSING FLAX FOR RETTING

Belgians have their pools very clean, and the cover used on the top of the flax, as well as for bottom lining of the pool, is often of basket or wickerwork, so that the colour may not be tainted by contact with the soil.

A few hours too long in the steep may give the fibre a yellow tinge which will detract from its value when brought to the market. On the other hand, if brought out too soon much loss is sure to result. When it is obvious by test that on breaking the stem of the plant the fibre separates freely from the woody part, then it may be concluded that fermentation has done its duty and the flax is ready to be taken out. This stage is accomplished by men standing in the water, for thus the bundles are washed and cleansed in lifting out, and the liquid can be kept in the pools until spread over the meadows—for it is an excellent liquid manure. If not so retained it can be run off into the stream during the first flood or "fresh," at which time its injurious presence to fish would be trivial indeed. It may be remarked *en passant*, that pure soft water is the best for flax-steeping and all waters of strong mineral qualities should be avoided.

Taken from the water the flax bundles are allowed to drain for a short time on the bank prior to being spread out over grass lawns to derive the full benefit of sun and air, which help to complete the step begun in the fermentation process. About the same time is required on the grass as was occupied in the pools, and when the flax appears dry and brittle in the woody part of the stem it should be gathered up into neat bundles, the stems being carefully ranged lengthwise, and transported direct to the scutch mill—or perhaps stacked like grain until some more convenient time. It is true that there are various systems of retting, but that described is the most common.

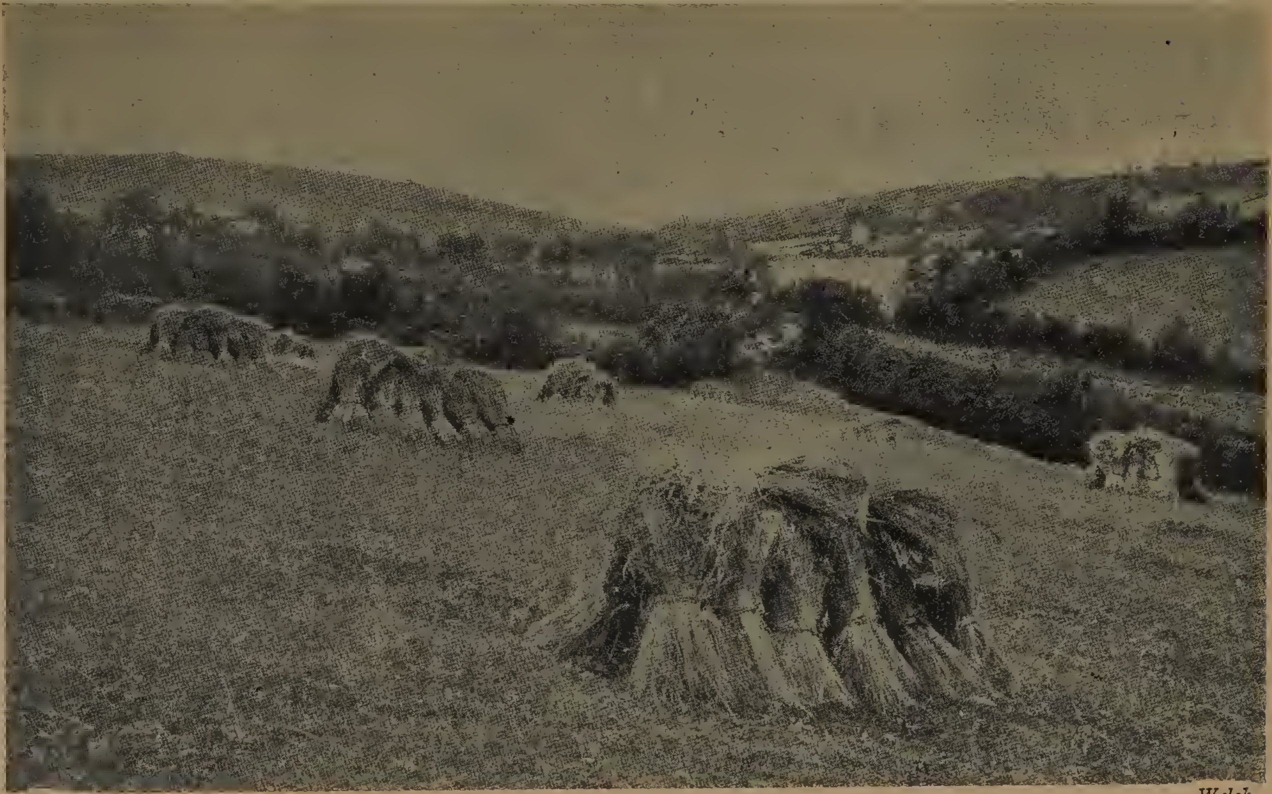


Photo by *Welch*

FLAX DRYING IN STOOKS

THE PROCESS OF SCUTCHING OR CLEANING

The next process we have to consider in regular rotation after retting and " grassing " is the separation of the fibre from the woody portion or straw. This operation is technically called " Scutching." It is not a very intricate operation, this scutching, consisting as it does in clearing the flax fibre of refuse, the finer portion being then in the first stage of " line " and the coarser " tow." Flax should not be scutched immediately after " grassing " since the straw is " husky " and fresh, and as much of the fibre is carried away the yield is much deteriorated both in quantity and quality. By keeping the straw in stack at least a month before scutching the fibre is much improved both in strength and silkiness, or, as some term it, in " spinning quality." It is also improved by merely buffing it at the first operation, and holding it over ten or twelve days before finishing it off.

Nothing could have been more laborious in human toil than the old mode of scutching by hand, and by that rude system of separating the silky fibre from the woody portion of the flax stems immense waste of the valuable material always took place. The introduction of machines driven by steam or water power superseded the hand labour. Moreover, mill-scutched flax commanded a higher price. Yea, to encourage the flax grower the Land Improvement Acts give power to the Commissioners of public works to lend money, on favourable terms, to needy proprietors for the erection of scutch mills in Ireland, so that landlords have every facility for providing their tenants with this important accommodation. In 1912 the total number of flax-scutching mills in Ireland was 644, and of these 638 were in Ulster, three in Munster, two in Connaught, and only one in all the big province of Leinster. The

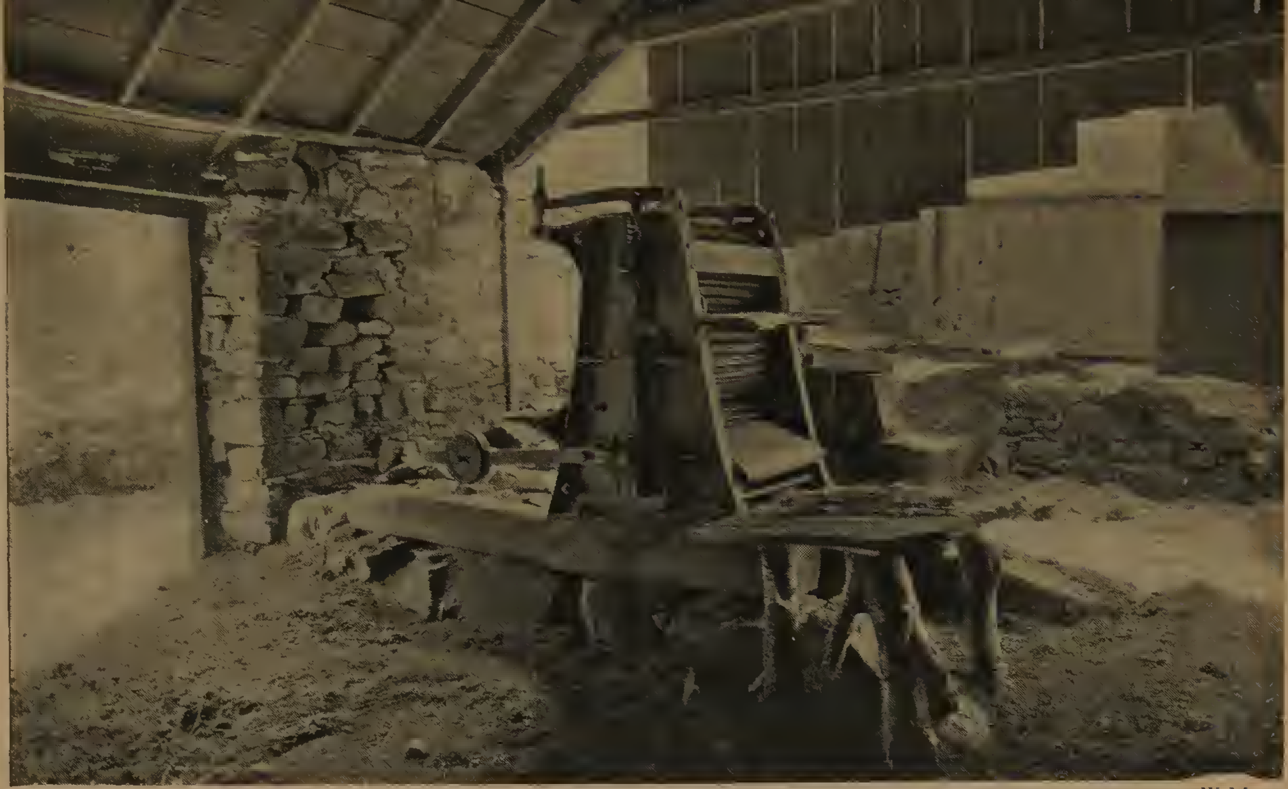


Photo by *Welch*

FLAX BREAKING BEFORE SCUTCHING

proportion of these mills in all Ireland to the number of acres grown was, therefore, one mill to every eighty-five acres under flax.

In the main the many varieties of scutching machines have the same common basis of working. Thus the flax is first subjected to the frequent use of a series of rollers to bruise and break the woody part of the plant before submitting it to the action of the scutching blades. The refuse taken off by these blades, technically known as "scutching tow," is of little value. Consequently the less time spent under this latter severe operation the more likely is the result to be satisfactory. The flax is very little, if at all, injured by the pressure between the rollers. When this process is successfully applied, as is usual, much less scutching is required, and with less waste the fibre is preserved in a more healthy and natural condition.

The operation of scutching renders the flax fit for market, and the farmer now acts with it as with any other crop. He either holds it for a high price or at once realises by sale. In several localities—and the principal markets are in Ulster—renewed efforts have been made recently to induce farmers and scutch mill-owners to take all their flax into the open market-place and cease selling at the mills. During 1912 prices ranged from 5s. to as high as 12s. 9d. per stone, but it is necessary to explain that while the high price was for really first-class fibre and the low price occurred at the end of the season, when all sorts of flax had to be cleared out—moreover, the average worked out at the same as the previous year.

AVERAGE VALUE PER TON OF IRISH FLAX

1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912
£52	£57	£56	£58	£50	£48	£61	£80	£64	£64

Now it is well, perhaps, at this stage if I explain that while flax was formerly grown in the United Kingdom, especially in Ireland where it was, at one time, cultivated to such extent that besides supplying the demands of the home industry a considerable quantity was exported. During the last fifty years, however, the cultivation of flax has declined, and at the present time Ireland only provides one-fourth of the supply of flax required by Irish spinners. A glance at the Board of Trade figures reveals that during 1913 the flax imported was 84,270 tons valued at £4,180,129 —*i.e.*, about £40 per ton—as compared with 87,078 tons valued at £4,348,595, or an average of £49 per ton for 1912. Contrasted with these figures the flax grown in Ireland during 1912 was 14,452 tons valued at £92,928, or an average of £64 per ton. Where, then, does the flax used by the Irish linen manufacturers come from? A glance at the Board of Trade returns shows the source to be as follows (see page 57).

IMPORTS OF FLAX AND TOW

Into the United Kingdom for the years 1911 and 1912, showing the increase and decrease in quantity and value compiled by the Board of Trade returns.

The imports from Russia are remarkable. The increase in quantity is 20,830 tons, and in value £701,130, *i.e.*, an increase respectively of 43·7 per cent. and 33·7 per cent. Eighteen years ago there was an equally large import of Russian flax, viz., 69,566 tons, at a total cost of £1,965,946. But the average cost then and now is very different since it worked out then at only £28 as against £41 per ton at present. The small figures in the table above referring to "other countries" show that our colonies do not help our flax supply greatly. We are told that in January, 1914, there was 1,620,000 acres under flax in Canada, and a production of about 3,200,000 tons of straw. Alas, the greater part is burnt for the seed is only saved for crushing. Considering that land in Canada for flax-growing may be rented from the farmers who will do all the work at £2 10s. per acre, there is no reason why flax should not be profitably imported from our Imperial province, with low freights, and carried by British steamers.

During 1911 as much as 34,005 tons of foreign flax and tow valued at £1,894,512 was imported into Belfast, while simultaneously 15,900 tons valued at £674,049 were imported into Dundee for the Scotch trade. So Russian flax is a very necessary article to the linen industry of the United Kingdom, though compared with flax from France, Belgium, or Holland, it is poor in quality, and with price correspondingly lower is employed in the production of the lower qualities of linens.

From.	Quantities.				Value.			
	1911.	1912.	Increase or Decrease.	Per-centage	1911.	1912.	Increase or Decrease.	Per-centage.
	Tons.	Tons.	Tons.		£	£	£	
Belgium, Flax .	12,130	16,205	4,075 inc.	33·5	1,053,964	1,421,529	367,565 inc.	34·8
Netherlands ,,	1,828	1,927	99 ,,	5·4	121,135	120,973	162 dec.	0·1
Russia ,,	47,623	68,453	20,830 ,,	43·7	2,076,777	2,777,911	701,134 inc.	33·7
Other Countries } ,,	730	493	237 dec.	32·4	31,179	28,182	2,997 dec.	9·6
Total Flax .	62,311	87,078	24,767 inc.	39·7	3,283,055	4,348,595	1,065,540 inc.	32·4
Russia, Tow .	11,758	12,366	608 inc.	5·1	388,874	415,990	27,116 inc.	6·9
Other Countries } ,,	5,960	6,486	526 ,,	8·8	121,331	128,159	6,828 ,,	5·6
Total Tow .	17,718	18,852	1,134 inc.	6·4	510,205	544,149	33,944 inc.	6·6
Total of both .	80,029	105,930	25,901 inc.	32·3	3,793,260	4,892,744	1,099,484 inc.	28·9

CHAPTER VII

THE SPINNING MILL

So far the flax has been in the hands of the farmer or grower, but now it passes into new possession, that of the spinner. We have seen the transfer accomplished at the market, and now it enters the spinning mill. It should be explained for the benefit of lay readers that " mill " in Ireland means specially a spinning mill, and " factory " means the establishment wherein is undertaken the further process of the manufacture of thread into cloth. It is true that many firms engage in both spinning and weaving, but for clearness it is better if we single out concerns which engage in only one of the two processes. Thus in most of the spinning mills flax is spun for sale as yarn ; in others owned by manufacturers, twist and weft are produced for consumption in the weaving factories, the surplus yarn being sold or the deficiency made up by purchase. However, while there is an entire absence of gambling in " futures," which has so demoralised the Lancashire trade, the conditions under which the business of the supply of flax is conducted present a very healthy contrast to those which prevail for the supply of raw cotton for the cotton industry.

It is not quite easy to arrive at a strictly accurate pronouncement with regard to the number of spindles presently in operation in the linen-spinning industry, but we are not far astray when we gauge them to be —as estimated by Sir William Crawford, head of the great York Street Mill, the largest linen factory in the world—somewhere about 948,080 belonging to some

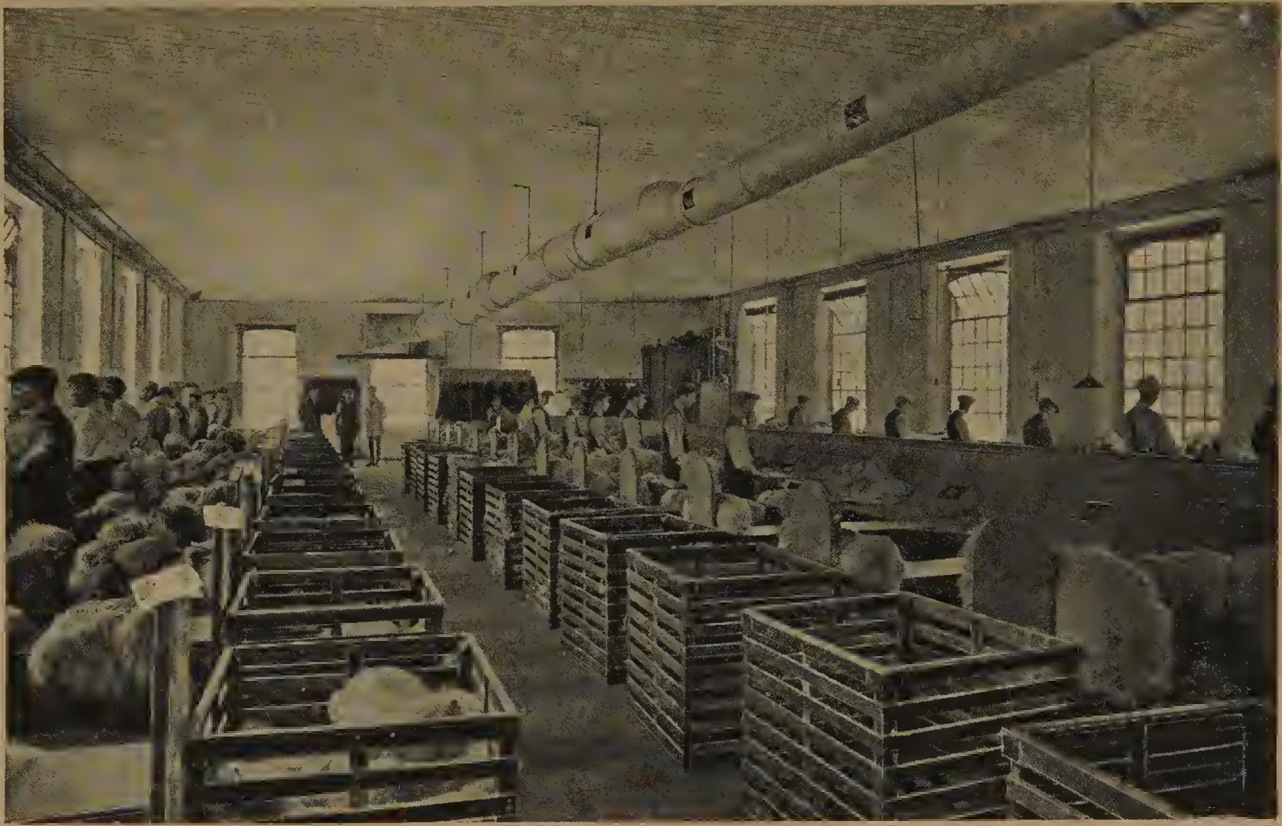


Photo by *Welch*

SORTING VARIOUS KINDS OF FLAX

fifty different companies. And of these spinning mills seventeen are in Belfast, one in Cork, and the balance scattered throughout Ulster.

An average-sized flax spinning mill may contain 20,000 spindles, and a mill of that size would give employment to about 750 persons. It would to-day cost £6 to £8 per spindle to erect it—and that means £120,000 to £160,000. The management of such a mill will consist of:—

1. The owners of the mill, or directors of the company owning it.
2. A mill manager.
3. A head spinning master, a head preparing master, and a head sorting master.
4. A flax buyer and a yarn salesman.

The workers are employed in the proportion of two or three females to one male. A few children of both sexes and of 12 to 14 years of age are employed as learners. These are what are called "half-timers," as they work and go to school on alternate days, and they cannot be admitted to work unless they attend school.

Fluctuations of Fortune

Here I may be pardoned if I digress somewhat to explain how the flax spinning business has come through many fluctuations of fortune. Sometimes it has been proverbially profitable—as it is at present—but much oftener it has been quite the contrary. For instance, during the American Civil War, the shortage thereby caused in the supply of raw cotton turned so many people to the use of linen that the price of linen goods became greatly enhanced. Thus during the years 1863–8 spinners made huge profits. Consequently in that time of prosperity a great increase of spindles took place. In fact, while there were 592,981 spindles

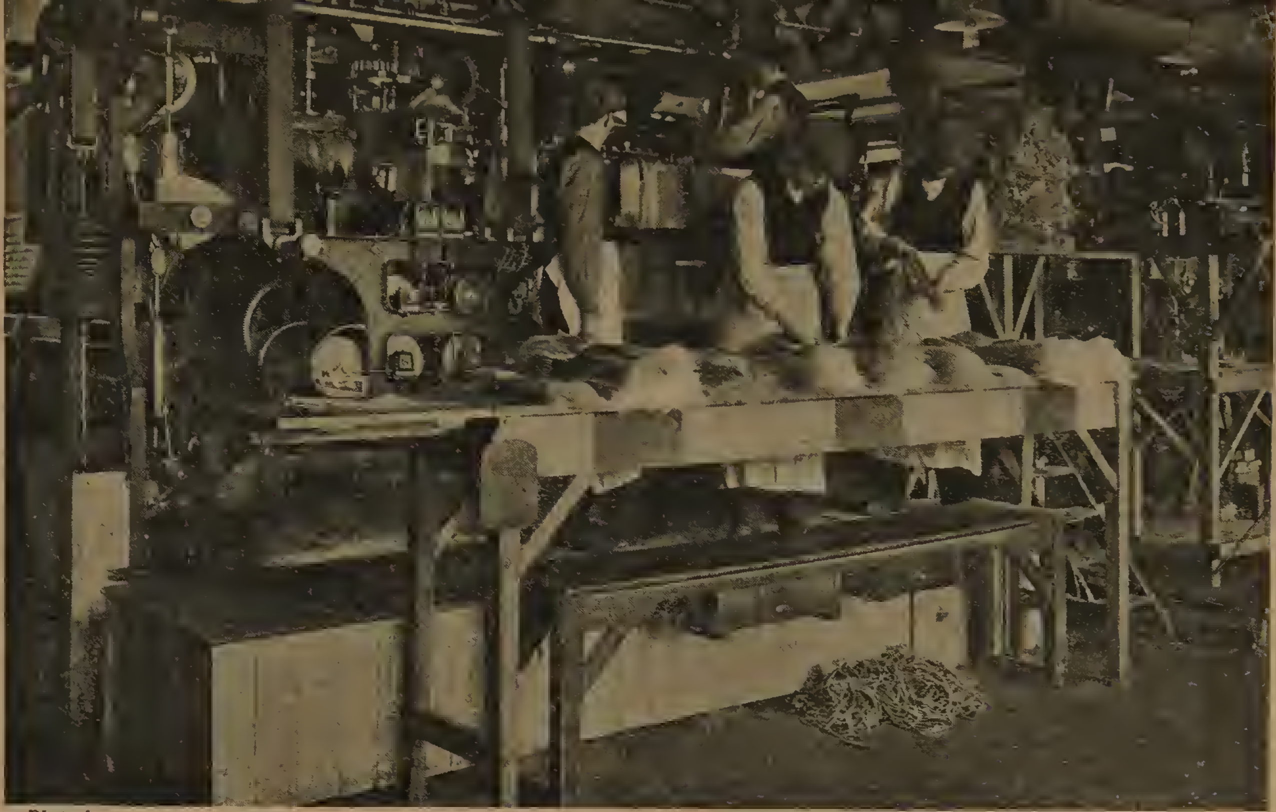


Photo by *Carter*

FLAX HACKLING AND DRESSING

in operation in 1861 the number within ten years had grown to be 906,943, and the area under flax reached its maximum in 1864, viz., 301,693 acres. In 1868 the record price for flax was touched, £82 10s. per ton, about £24 above its normal. But, of course, when cotton supplies assumed their normal proportions the demand for linen goods diminished, and for the next thirty years or so there were about seven lean years to one fat one. No fewer than thirty-six spinning mills were brought to insolvency, or at least to such financial difficulty that eighteen of them, with 200,000 spindles, ceased to exist. Simultaneously the other eighteen mills continued under new owners; but even of these eighteen six have changed owners twice, while one of the largest mills lived through the long protracted crisis in so crippled a condition that it was unable to pay any dividend to the shareholders during twenty consecutive years. On the other hand, a few mills in specially fortunate circumstances maintained a moderate degree of prosperity, and even increased the number of spindles owned by them.

In the storeroom of the spinning mill we see flax as it comes in from countries so diverse as Ireland, Belgium, Holland, and Russia, and the difference in quality is quite apparent to the least initiated. The better scutching and retting of the Belgian fibre probably accounts for most of its superiority over the home grown. Yet even the best scutched flax is, however, very far from ready for the actual process of spinning, and it has first to undergo repeated combings and cleanings. The first of these cleanings consists in passing the fine fibre to a cutting machine which cuts off bluntly, or rather tears off, the low ends and the tops of the stems, leaving the prime centre part for the best yarn, though some coarser varieties are passed on without this cutting.

By various stages of preparation the last vestiges of bark left by the scutcher are removed, and all dirt cleared away, and when these are over the flax is ready for "hackling."

HACKLING

Whether flax is to be spun into yarn by hand or by machinery it has to be hackled—that is to say, combed over sharp-pointed pins till the strips of fibre removed from the stalks of the flax plants are divided into apparently single fibres. This division is only apparent, as the ultimate fibres of the flax plant are about 1½ inches long, tapering at each end to an exceedingly fine point. A great number of these ultimate fibres are stuck together by the natural gum in the plant, and form what look like the long fibres resulting from the hackling. We cannot describe the hackling machine save as a masterwork in mechanical ingenuity. A boy feeds in the *materiel* and the machine does the rest, unscrewing bolts, shifting plates, re-screwing the bolt, and so on. "It can do everything but think," is what occurs to the observer, but as it is wanted to work and *not* to think this is perhaps an advantage. This "hackling" is really another combing and brushing. Imagine a man holding a bunch of flax in one hand, and combing it with the other; then changing hands from top to bottom to comb it right through, and the action of the machine may be fairly understood. On it goes automatically passing each handful along a row of combs from coarse to fine, until a screw comes into action, loosens a nut, moves the flax round, tightens up the nut again, and starts on its return journey.

Having mentioned this machine it is right that we should give deserved prominence to its inventor, Mr. James G. Crawford, a director of the big York Street linen concern. It has worked quite a revolution in economy and efficiency. Formerly four boys were needed to attend a pair of hackling machines, and the work devolving on each of the four boys was exceedingly arduous—so arduous that they remained at it only so long as they were unable to obtain work at another industry. By this invention one boy now can attend to a pair of hackling machines instead of four boys, and the one boy's work is exceedingly light. It thus effects a saving of 75 per cent. in wages, and in addition the work is better done, and practically all the boys can be retained and advanced to apprenticeship in one or other of the trades connected with the flax industry.

It might be thought, after seeing the operation of this exceedingly handy and ingenious machine that there was little left to be done in the cleaning and combing of flax, yet it is handed over to expert workers who comb it with very fine combs and sort it according to the various grades. This does not mean that the flax has been mixed in the previous processes, but merely that even in flax which is bought together in one lot and as one growing, there are shades of quality which are noted by the expert and the material is divided accordingly.

After all these cleaning processes are over, the flax goes next to what is termed the "Preparing Room" in reality one of several "preparing rooms"——where there is an endless variety of machines and the brain begins to whirl in sympathy with the wheels. It is soon discovered, however, that there is order in this apparent chaos, and that the machines are working in little series or sets of four or five, one of which may be taken as illustrative of all. When flax is to be spun by hand a bundle of this hackled flax is put upon the distaff, and a few of these long fibres, differing in number

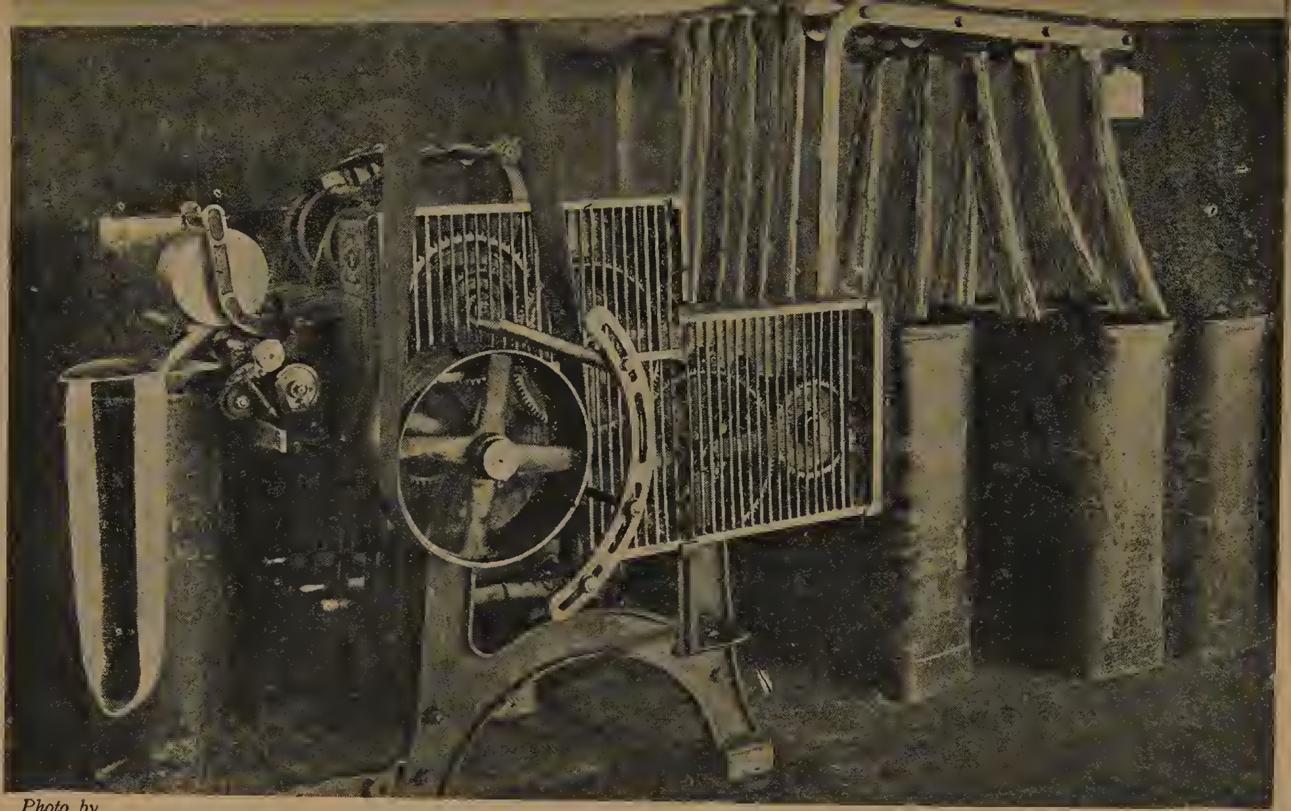


Photo by *Carter*

FLAX DOUBLER

according to the fineness of the yarn to be spun, are, by the selection of the spinner and without any further subdivision, introduced directly into the yarn as it is twisted and wound on to the bobbin in the spinning wheel.

THE SPREADER AND SLIVER

Now the process of hand-spinning, though producing a better thread, is by nature impossible of application to the spinning of yarn by machinery, as the spinning frame cannot make that selection of individual fibres which takes place in hand-spinning. Therefore, in machine-spinning quantities of hackled flax, such as are put upon the distaff of the spinning-wheel, are fed into a machine called a "spreader," each quantity or piece overlapping the preceding one. These all issue from the machine in one continuous band or "sliver," which is too thick and too irregular to form yarn. As these ribbons emerge from one machine they are passed to another, and at each step they are drawn out longer and thinner, until in the last of the series, called the "Roving Frame," the fibre is twisted into a loose, thick thread, not unlike what we are familiar with as grey woollen knitting yarn and known as "rove."

This rove, which is a loose-twisted thread of from five to twelve times the thickness of the yarn required, next passes into the hot water trough of the spinning frame, where the natural gum, holding together the ultimate fibres of the flax, is softened. Upon issuing from the trough the rove passes between two pairs of rollers, the second pair running faster than the first pair, which draw these fibres past each other, thereby extending and reducing the filament to their required degree of fineness, and deliver them to the flyer which twists them up tight and winds them on the bobbin.

The subsequent drying of the yarn hardens up again the natural gum of the flax plant, and gives the yarn the firmness required to allow of its subsequent handling in the manufacture of cloth or thread.

MEASURING THE YARN

The yarn is now, so far as processes of manufacture are concerned, practically a finished article of commerce. So without any further treatment save being unwound in the " Reeling Room " and being measured on the reels—60,000 yards making a bundle, which is subdivided into " hanks " and " cuts." Each hank contains 12 cuts, or " leas," and each cut 300 yards ; consequently 16⅔ hanks are equal to a bundle. The bundles are then tied up in bunches of 3, 6, 9, or 12 according to quality—and so, after being carefully dried by steam in the lofts, the yarn is ready for sale. The finest spun for commercial purposes is about 340 leas of 300 yards each to 1 lb. weight though it has been worked up to 700 leas for special purposes. The coarsest spun out of pure flax is about 20 leas to the lb.

Many other countries such as Egypt, Portugal, Brazil, Canada, and Japan are also buyers of linen yarn both for manufacturing linen cloth and for other commercial purposes. Since they have not the skill and experience of the Irish spinner in producing a strong and even thread. I have already explained that Ireland does not produce more than one-quarter or so of the flax necessary for manufacturing linen in Erin's Isle, so necessarily much linen yarns must also be imported. At any rate during the year 1911 there was imported into Belfast 10,934,975 lb. foreign linen yarn valued at £485,985, or 10s. 6d. per lb., and of the total Belgium supplied about 70·1 per cent., while France, Germany, and Russia supplied the rest.

The yarn is now ready for marketing and as such is exported all over the world. Thus the

Linen Yarn Exports during 1912

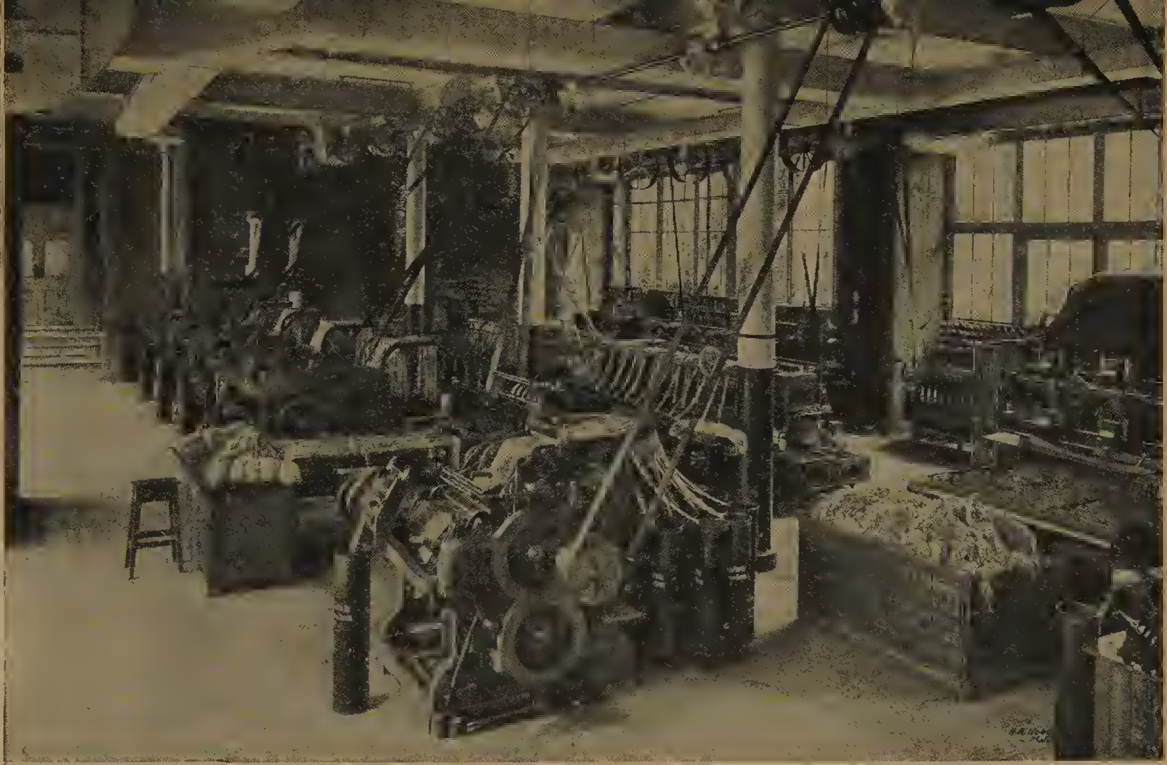
from the United Kingdom were as follows:—

QUANTITY

	1909.	1910.	1911.	1912.
To	lbs.	lbs.	lbs.	lbs.
Belgium	1,769,800	2,659,300	2,237,100	2,564,600
Denmark	285,400	290,600	146,000	156,000
Egypt	1,538,400	1,861,600	1,685,900	1,015,700
France	362,300	459,700	459,700	520,800
Germany	3,660,300	4,056,100	4,012,500	3,755,300
Netherlands	1,440,600	1,814,200	1,721,300	1,809,800
Italy	..	..	..	..
Japan	..	514,300	262,200	327,300
Russia	56,000	76,600	118,600	60,600
Spain	1,182,100	1,315,400	1,361,900	1,239,300
United States	1,778,600	2,149,800	2,271,200	2,506,500
Other Countries	3,459,400	3,351,300	3,726,600	3,715,200
Totals	15,532,900	18,548,900	18,003,000	17,671,100

VALUE

To	£	£	£	£
Belgium	151,050	223,114	212,106	243,938
Denmark	15,567	21,364	12,246	13,956
Egypt	58,315	72,410	68,882	46,211
France	43,235	58,614	65,086	83,419
Germany	295,027	337,372	347,686	336,178
Netherlands	60,319	78,392	77,733	87,226
Italy	..	..	..	..
Japan	..	35,982	21,273	24,177
Russia	6,928	10,242	16,231	11,212
Spain	73,230	84,706	92,602	97,949
United States	85,116	115,616	126,344	128,391
Other Countries	164,077	159,136	178,805	195,832
Totals	952,864	1,196,948	1,218,994	1,268,489



SPINNING

Belfast Municipal Technical Institute

The "tow" thrown off in the hackling process is not allowed to go to waste. It is collected in bags, shaken out by a special machine, and then undergoes a most elaborate "carding" or combing process, ending in being reduced to a large ribbon ready for "drawing" and spinning, as already described, for the "flax" or line. The yarn from tow is used for making only coarse articles; it has a peculiar softness which renders it very suitable for towelling, being pleasant to the skin and an excellent absorber of moisture.

It seems scarcely worth while to devote much space to the consideration of the manufacture of linen thread, being closely allied to yarn and only differing from its production by being subjected to certain special processes. However, that it is in itself an industry of immense importance giving work to thousands may be concluded when we know that the Linen Thread Company, which is a combine of half a dozen of the largest concerns in this special line, has a capital of nearly £3,300,000, and yielded net profits for 1912 of £224,583 and for 1911 of £245,987. During 1912 the quantity of linen thread exported—mainly to Australia, United States, Germany, and Canada—was 2,667,300 lb. valued at £343,792. So in itself the thread manufacturing branch of the linen trade must be reckoned as no mean industry.

CHAPTER VIII

WINDING, WARPING, AND WEAVING

SOME spinners sell all the yarn they produce in the home market, others have a large export demand. Some make the yarn into linens, bleach them, and become regular linen merchants; others have power-loom factories and sell the linens in the brown state, after being manufactured on the spot. In spinning we had the transformation from hand-spinning to mill-spinning. In weaving a similar transformation took place. Seventy years ago it was thought impossible to manage flax yarn in a power loom, and certainly the first attempts were very imperfect. But gradually by perseverance and skill the difficulties have been removed almost entirely, and all classes of goods are now turned out equal, if not superior, to the production of the hand loom. The only point that appears still in favour of the hand loom is the selvage or edge in heavy goods, yet even here the improvements in mechanism have atoned very considerably indeed. The hand loom is preferable to the power loom for tender and fine yarns, the manufacturing of the finest cambrics being an example of this.

Ireland began about 1850 (after England and Scotland) to use the power loom for linen weaving, and in this also it has outstripped them. There are in Ireland 37,292 power looms, owned by 100 companies. Of these looms 22,000 are working in Belfast; 13,000 are in other parts of Ulster, and 2,888 scattered in small factories in Dublin, Cork, Dundalk, and Drogheda. As compared with the 37,000 power looms in Ireland, Scotland has 17,000, and England 4,400 using linen yarn.

Eight weaving factories in Belfast and eight others in different parts of Ireland are attached to spinning mills, but that system is not growing. In 1872 9,000 looms were attached to mills; now the number is a few hundred less. The growth, or extension, has been in factories separate from the mills; thus in 1872 while there were 9,000, now there are 28,000 looms. The chief cause of the growth of factories separate from mills is that a factory must be placed in proximity to a centre where workers are to be had who have some dexterity in handling yarn or in weaving, while any saving effected by obtaining yarn from one's own mill is but small.

A power-loom factory for the weaving of light and narrow linens will cost £40 or £50 per loom. A factory for making wide damask or sheetings will cost £100 and up to £200 per loom. The management of a weaving factory is composed of:—

1. The owners of the factory, or directors of the company owning it.
2. A manager.
3. A foreman in the department where the yarns are prepared, with under him—
4. A foreman over the warp winding, a foreman over the weft winding, and a warping master.
5. A number of tenters, each one of whom supervises fifty to seventy looms.

Generally one weaver attends to two looms, but for wide goods there is a weaver to each loom. Women attend to the looms weaving narrow and light cloth, and women also sometimes attend to looms making wide and heavy cloth, but many of such looms are attended to by men.

Wages are paid by piece-work, and the same scale applies to men and women. The light end of the work is done by women, the heavy end by men, and between

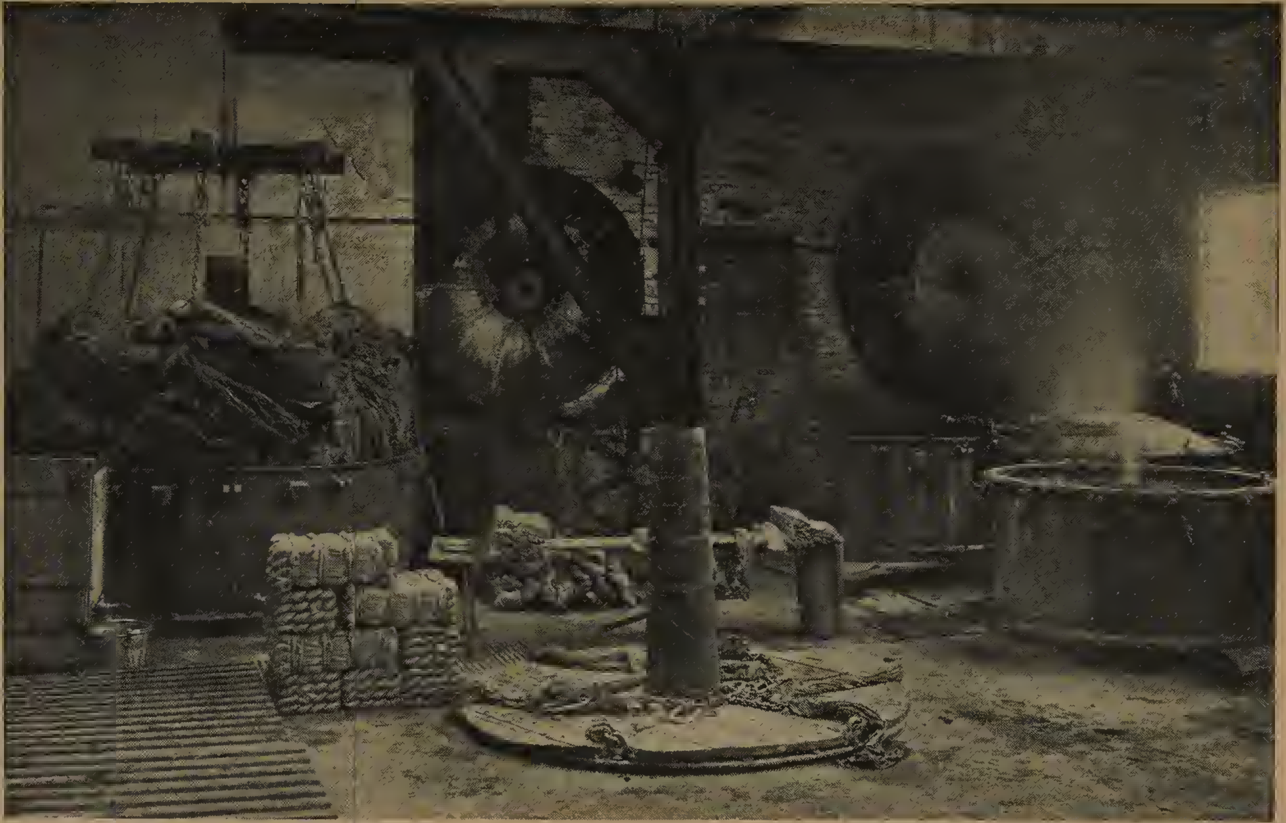


Photo by Carter

LINEN YARN BOILING

the two by either sex. The wages of tenters and other skilled men employed are comparatively high. The number of all persons employed in and about a weaving factory is somewhere as many as the looms it contains.

We chose for illustration the apotheosis of a linen handkerchief so we revert again to it. So far we have only reached the half-way—the yarn stage—in its story. Examine a handkerchief closely, and you will observe how it is made up of countless fine threads crossing one another and always at right angles. Originally these threads were of the raw greyish colour of the yarn as we have seen it leave the spinning mill in hanks. How the threads of yarn were woven into cloth is our next step of interest.

There are two plans of preparing yarn for weaving by power. The first plan is to send it to the factory direct, without any special preparation. The second plan is to cleanse it by considerable changes, the principal of which are known in the trade as "boiling" and "bleaching." The first plan does well enough for light linens, or those sold for use in the brown state. It is chiefly those yarns which are intended to be used for fine white linens which are boiled, as this reduces the bulk of the yarn considerably and enables it to be woven into a tighter and finer cloth. The yarns which are bleached are mostly such as are intended for glass cloths, cream damasks, apron dowlas, huckabacks, towels, etc., and are not as a rule bleached after being woven. However, many articles which receive the full bleaching treatment are also made from bleached yarns for various technical reasons.

WARPING

When the weaver receives the yarn, whether it be in its natural grey state, or boiled, or bleached, he has

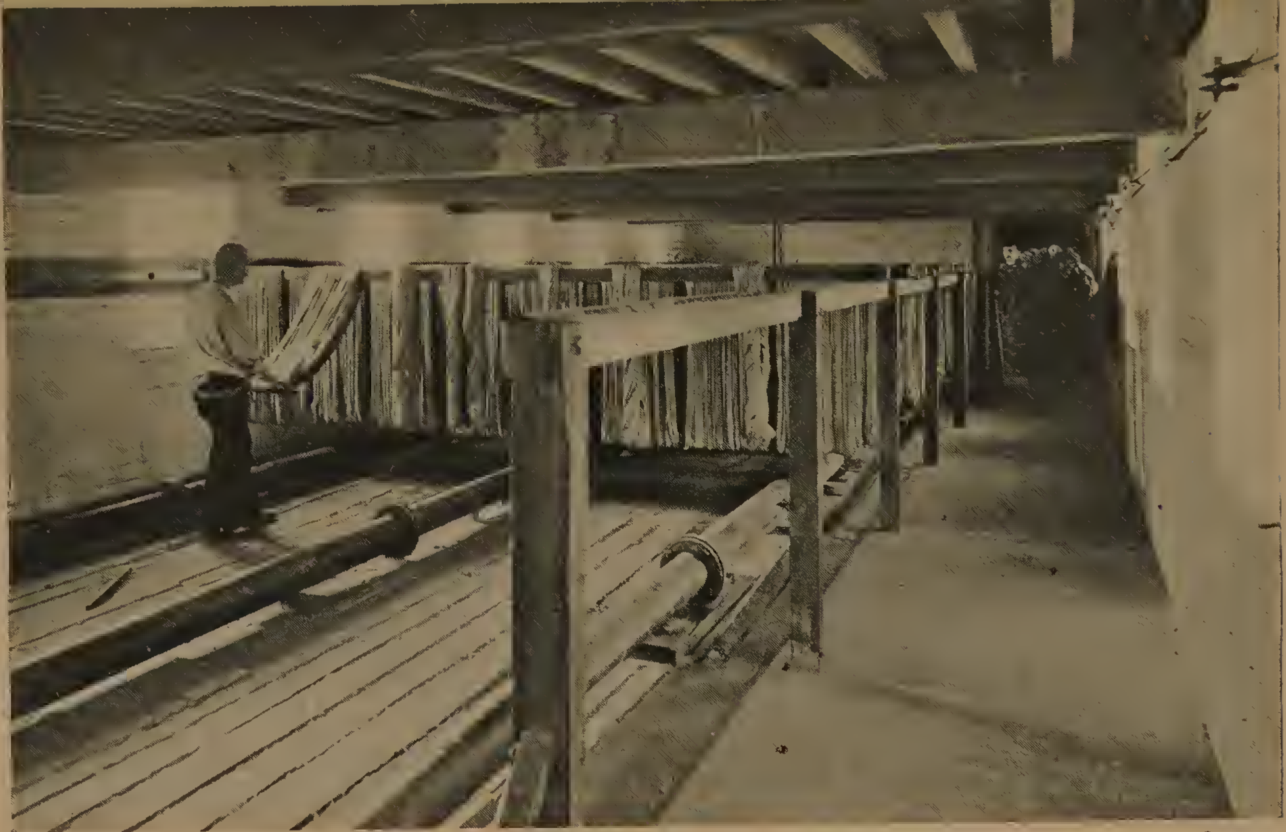


Photo by Carter

LINEN YARN DRYING AFTER BOILING

to prepare it for his looms. Instead of being " reeled " it is wound by machinery from the hank on to large spools. These spools are put on an upright winding-frame called a " bank," and from it the yarn is drawn by the warping machine through a long reed, or rather series of reeds, resembling a grating, and having more or less opening or " splits " according to the fineness of the fabric to be made. This warping machine has the yarn arranged like the strings of a pianoforte, in fact, the linen lies longways without the cross-threads, and folds it thus on a roller. This roller when filled is carried to the dressing-room, where it is passed through a paste made from Irish moss (a kind of starchy seaweed), or some such substance, and afterwards nicely brushed. This little operation, which causes the fibres of the warp to adhere more tenaciously to each other, prevents the weft catching on the warp and permits it to slip along more easily. The warp is again restored to a roller and then is ready for the power loom.

Weaving

There are many technicalities connected with the power loom with which the reader need not be troubled. As the principle, however, in these intricate machines is virtually the same as that of the hand loom it would be well to explain the meaning of the words " warp " and " weft." The warp carries the threads which run the whole length of the cloth—and in the warp of the full piece of fine shirting, damask, or linen, there may be fully 400,000 yards of yarn—while the shuttle flying across leads the threads comprising the weft under and over them alternately. With the weft yarn placed in the shuttle the girl starts the loom. Perhaps the weft yarn breaks after crossing two or three times, and if the girl is not watching, you think the loom will go on

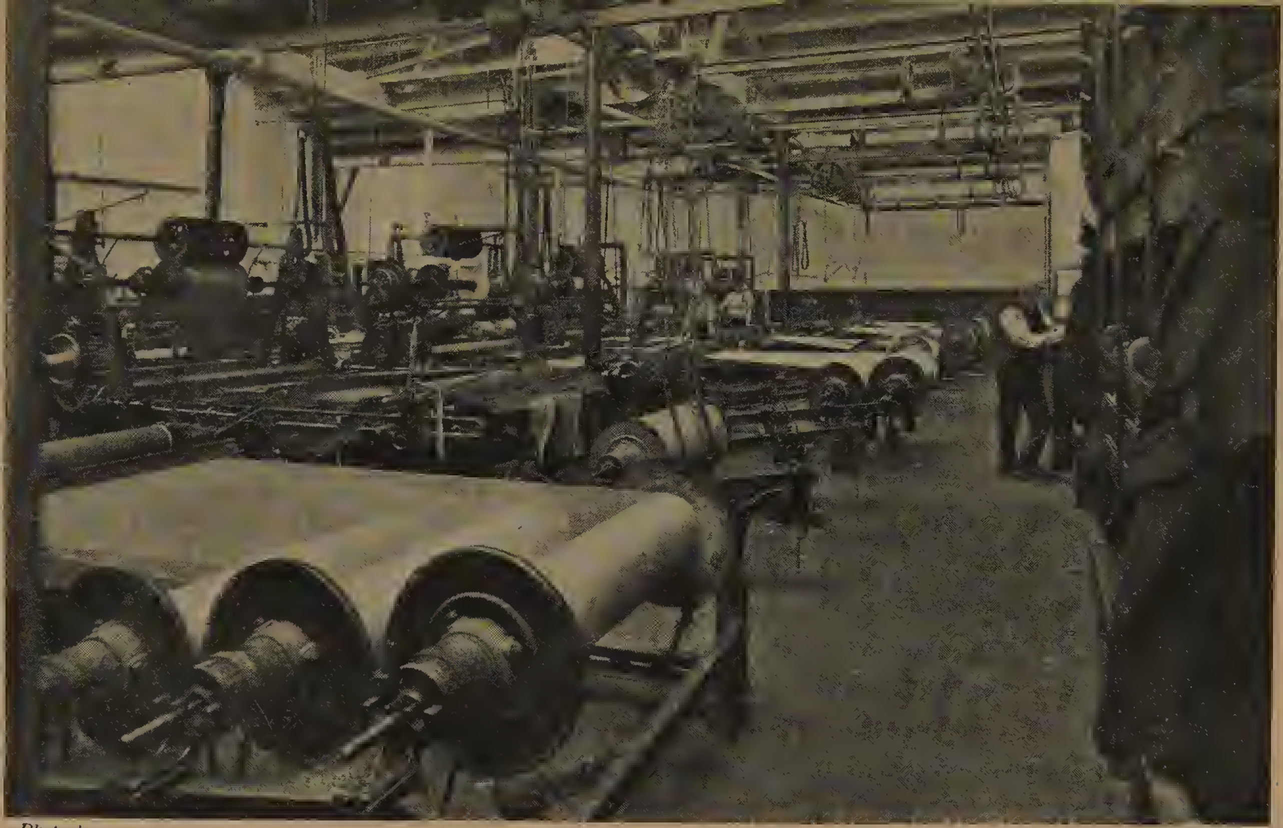


Photo by *Carter*

DRESSING WARP YARN FOR LOOMS

trying to weave. No such thing: though not endowed with animal life, the loom shows in its clever mechanism the intelligence of man. There is a peculiar little catch-wheel with a lever ending in a fork—the invention of a working weaver called Bullick—so arranged that the weft yarn must gently touch it in passing. If it fails to do so then the catch-wheel stops the loom.

I have alluded to the difficulties at first experienced in establishing the weaving of flax yarn by power. Writing in 1785 the then Lord Sheffield declared, "The aid that has been given to labour in the cotton manufactory by machinery is not likely to be applied to the linen manufacture in any great degree." It is true that flax is not an elastic fibre like cotton, and consequently the ordinary cotton loom as it exists in England is impossible for linen weaving. However, by a modification a vibrating roller was brought into use, which comes and goes as the "headles" move up and down, and so prevents any irregular strain on the yarn. This roller is not used for cotton, and a heavier and stronger kind of loom is required for flax than for the other material.

The spinning rooms of a large factory, such as York Street Mill, are a great sight, which might occupy us longer only that there is so much to be done. The immense number of looms at work, the rattle of the shuttles which rises into a deafening roar, and the curious effect of such a mass of movement is almost overpowering. Here we see machines of the most intricate appearance working away without supervision almost, and doing the work of thousands of workers. To spin and weave by hand the amount now produced by this one concern alone would mean the employment of at least half a million workers, and, of course, at a price which would make the disposal of the linen

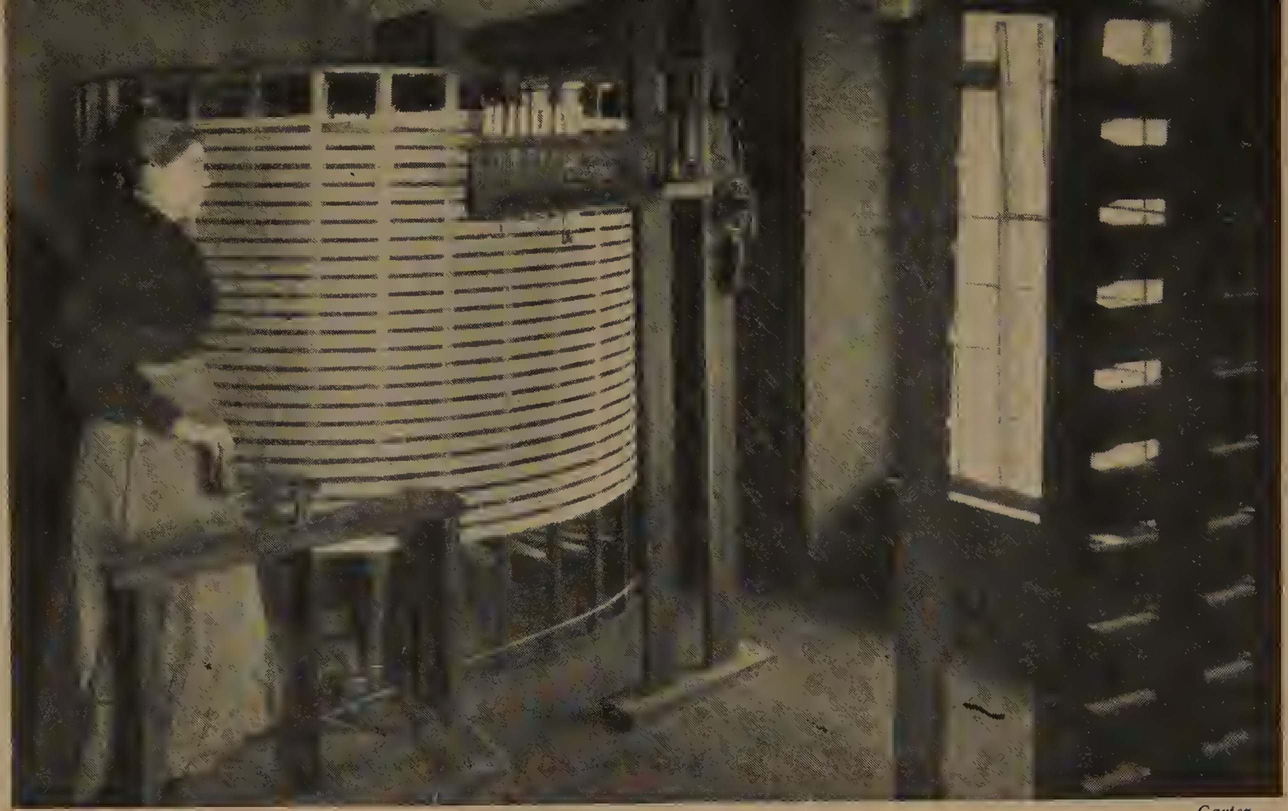


Photo by *Carter*

HAND WARPING FOR HAND WEAVING

impossible. It is fascinating to observe the various motions in the machinery of a power loom—the roller gently pulling on the cloth as it is made—the sley driving tight home the weft which the little shuttle slips in between the divided yarns of the warp—the heddles raising the alternate sets of yarn to receive the next shot of weft—the striker, which represents the weaver's arm—propelling the shuttle by a blow across to the other side of the loom—all these actions succeed one another in regular rhythm, and as each thread of the weft is pressed up closer to the one which preceded it, so a compact piece of cloth is gradually growing with each beat of the loom. In this way plain linen stuff is woven. In a hand loom, two to four of the outside yarns are put in double, to strengthen the selvage. The action of the power loom is, perhaps, more trying, and it is found advantageous to use five or seven double threads to strengthen the selvage.

The Jacquard Loom

When it comes to fancy linens, towels, damasks, etc., a more complicated process of weaving is resorted to than that I have described. It was the discovery over a century ago of a method of working in patterns which made the name of Jacquard, the French silk weaver, known throughout the world and brought about a revolution in producing fabrics. Its foundation is a series of cards perforated with numerous apertures and resembling nothing so much as the music roll for a piano player, yet it is by the arrangement of these small holes that the pattern is given to the cloth. How it does so would puzzle the uninitiated observer—so I will attempt a description. Above the loom is arranged a number of wires shaped like a cross, and from these, cords descend to the warp yarn. The cards, perforated

POWER-LOOM WEAVING
Belfast Municipal Technical Institute

to suit the pattern, pass over a square roller, and each card is pressed against the ends of the little wires, so that where the card is perforated the wires slip through. This motion raises the cords, and, consequently, the portion of warp yarn attached to the cord. The weft now shoots across, and a part of the web not being raised in the warp, the weft escapes it. By this means, instead of all the weft lying alternately between the warp yarns, it is only the plain ground of the damask that is so done.

The patterns are uneven in this respect, and this makes them show to the eye when glancing along the cloth. In complicated patterns an immense number of these little wires are required, and some expensively mounted looms will cost £200; the very common ones probably £100. The arranging of patterns and the placing of the cards calls for expert skill and is almost a fine art in itself.

Hand-Loom Weaving

Though the vast bulk of the linen-weaving industry is now carried on by the steam-driven factories, still it must not be supposed that the hand loom is entirely superseded. Even in this era of almost perfected machinery the finest class of work, such as serviettes, tablecloths, d'oyleys, etc., of the purest linen yarn are woven by hand alike in factories and in the cottage homes of the weavers. It is work well suited, since all the members of the family can lend a hand, the children and the aged winding the unbleached yarn on the bobbins for the weft, the young men and women weaving the narrower and lighter looms, and the able-bodied men the wider, heavier, and more complicated ones. The factories are generally limited to the weaving of damasks and wide sheetings, as in both these cases

HAND-LOOM WEAVING
Belfast Municipal Technical Institute

the looms—worked by hand—are almost too expensive for the weaver to purchase himself. A respectable weaver is often, however, allowed to take the loom on loan to his house, and to see him labouring at a heavy piece of sheeting, perhaps three yards wide, which he is expected to turn out quite even without a blemish, for sixty-four yards long, gives one a convincing proof that he, at least, among the sons of Adam, is "earning his bread by the sweat of his brow." In the Ballymena district hand-loom weaving is somewhat extensive, the products being used for shirtings and known in the trade as "Ballymenas."

As showing how hand-loom weaving is fast vanishing it may be mentioned that while in 1893 the wages paid for this class of work was £220,000 it is now only £55,000 per year. The cost of a hand loom is about 30s., and it requires an equal sum for heddles and reed, making the total amount £3.

CHAPTER IX

BLEACHING AND FINISHING

WE are still progressing in the evolution of our handkerchief though we appear to be somewhat distant from the final stage. Fresh from the weaver's cottage, or the power loom of the factory we have before us a web of rough, coarse, strong, brownish fabric. It seems nigh impossible that this dirty-looking cloth will become transformed into my lady's dainty handkerchief ; but that is so, as we shall see. The usual practice is for this web of brown linen to go straight from the loom to the bleacher. The majority of the goods certainly go this way ; a large portion of the remainder are finished brown ; some are coloured after being finished, others are partly bleached and then dyed ; and of late years a great many have been bleached and afterwards printed with fancy patterns, in which there appears to have been both great improvement in novelty and elegance of design. Bleaching is defined by Dr. Ure to be " the chemical art by which the various articles used for clothing are deprived of their natural colour and are made white." Until this very day the old-fashioned methods of bleaching are usually employed, and Nature, in the shape of her moist climate, defying art in the person of the chemist, more than maintains its pre-eminence for producing that dazzling pure whiteness which can only be found in Irish linen, bleached on the lovely green fields of the Emerald Isle.

To see the long strips of linen spread out on Ulster grass fields, and the loading and unloading of it like so much hay, while the freshness of the air and the charm of the surrounding scenery serve to brighten the effect, is a sight which will not be readily forgotten. In fact, it is the first impression the visitor gets as he passes the little station of Hilden, where are situated the works of the Richardson and Barbour firms, the latter combining both linen and linen thread manufacture extensively, on the railway entering Belfast from Dublin.

In olden days bleaching could only be carried through in the long days between March and October, and it was performed by primitive methods, such as boiling the linen in lye made from burned seaweed, and then spreading it on the grass field exposed to the effects of sun, air, and rain, as well as artificial watering. After six months or so of this treatment, the linen was steeped in buttermilk, washed in pure water, and finished up. The colour obtained by these methods was not so white as is now common, but the bleached linen retained a high proportion of its natural strength. With steam-driven spinning machinery there ensued so great a development of linen manufacture, and of the demand for it from foreign markets, that a speeding-up of the process of bleaching became more necessary. A whiter colour was also demanded, and so the use of more chemicals, with shorter exposure on the grass became the rule.

The manner of bleaching that has been carried on for many years past is something like the following :—140 webs of yard-wide brown linen, each one marked on the end with red thread in a way to be identified, are stitched together end to end making one piece of, say, 10,000 yards. This is called a " pot," and in common parlance is spoken of as " she." It is first passed through a solution of lime into the boiling pot, and there boiled eight or ten hours. It is then drawn through a tank of water. The webs are next unsewn and each one is

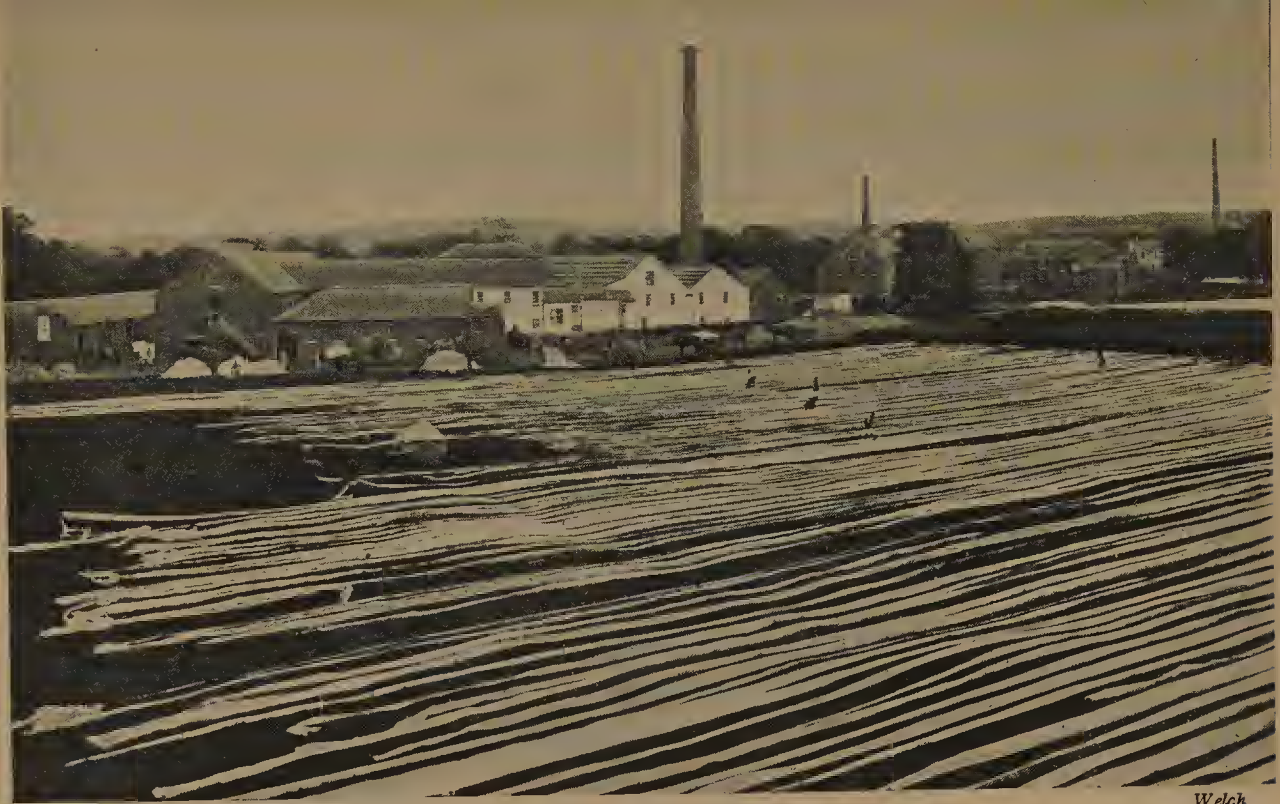


Photo by *Welch*

LINEN BLEACHING GREEN AT HILDEN

bundled separately. The bundles are now washed in the wash mills with pure water for an hour, then steeped in a sour of dilute hydrochloric acid to convert the residue of the lime into a soluble salt; washed again in the mills, boiled in soda lye, which, combined with the waxes and fats in the fibre, makes them into soap and hence removable. Again the fabric is washed before being put on the grass for some days, boiled again in lye, washed, put on the grass, rubbed in soap and water, boiled in lye, washed, put once more out on the grass, and so on.

As soon as it is considered to be sufficiently boiled the whitening process is begun by the use of bleaching powder or "dip," in which the cloth is left overnight. It is washed, treated with weak sulphuric acid, boiled again in soda lye, such processes being repeated until the cloth is found to be of a proper whiteness. I may here remark, that the fancy for extremely white linens has made the business of a bleacher very risky, as, in the endeavour to please the eye, it may easily happen that he may be tempted to go too far, and thus impair, to some extent, its durability—in fact, wear it out prematurely. A fair, even colour, without injury to the fabric, can be attained, and beyond that bleachers should allow no pressure to urge them.

In linen-bleaching there is a big field for the services of chemical research. The present methods are so uncertain and irregular as to carry with them serious risks of damage to the goods. A pot may be taken as worth £500, and in the north of Ireland seven or eight thousand of such pots are treated each year. One may thus form an idea of the magnitude of the risk. Here, then, is a practical object for our scientific men to have before them. However, there is much hope of improvement in the future when we consider how thoroughly

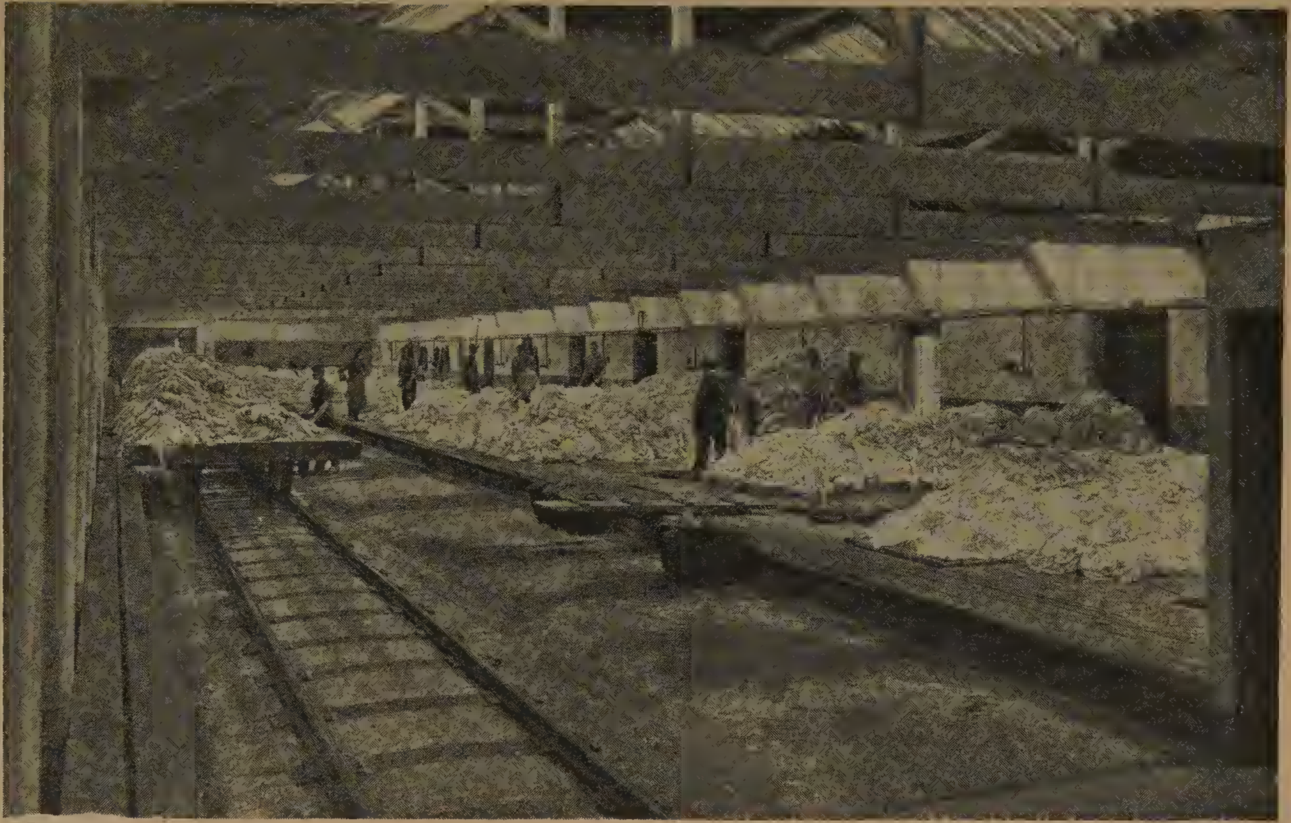


Photo by Carter

BLEACHING. CLOTH TAKEN FROM STEEP VATS

practical are the opportunities afforded for research and improvement not alone in the laboratories at Queen's University, Belfast, but also in the specially and splendidly equipped textile department of the Belfast Municipal Technical Institute.

The introduction of soda ash, and the centralising of business in large concerns, has wonderfully cheapened the cost of bleaching. Not so very many years ago, a piece of light yard-wide linen would cost the merchant probably 3d. per yard to bleach, which is now done for less than 1¼d. and in one-third of the time. Sixty years ago, 2,000 or 3,000 pieces would be trade for one establishment for a whole year ; but now it would not satisfy a large concern to bleach twice that number in a week. At the same time bleaching has been found to be unprofitable during recent years, and so the Irish bleachers and the Scotch bleachers have been obliged to form an association binding them to regulate their prices and terms by common agreement. They are entitled to have a fair living out of their business, and may have it without injuring the other sections of the trade.

The grass bleaching is probably the secret of Ireland's white, soft linens, for every piece is spread out in the sun and in the dew on the clean grass of the sloping field. Naturally very much of the linen which finds its way into the world's markets has seen very little in the way of grass bleaching, as the use of lye and acid baths is depended on by some bleachers to an almost exclusive extent. However, there are other concerns more conscientious in their work and ideals. If an inquiry is made of a bleacher how a certain pot is coming on, or at what stage it is, the reply will probably be, "'She' is doing well," or "'She' is ready for the blueing." A witty bachelor once suggested that a pot

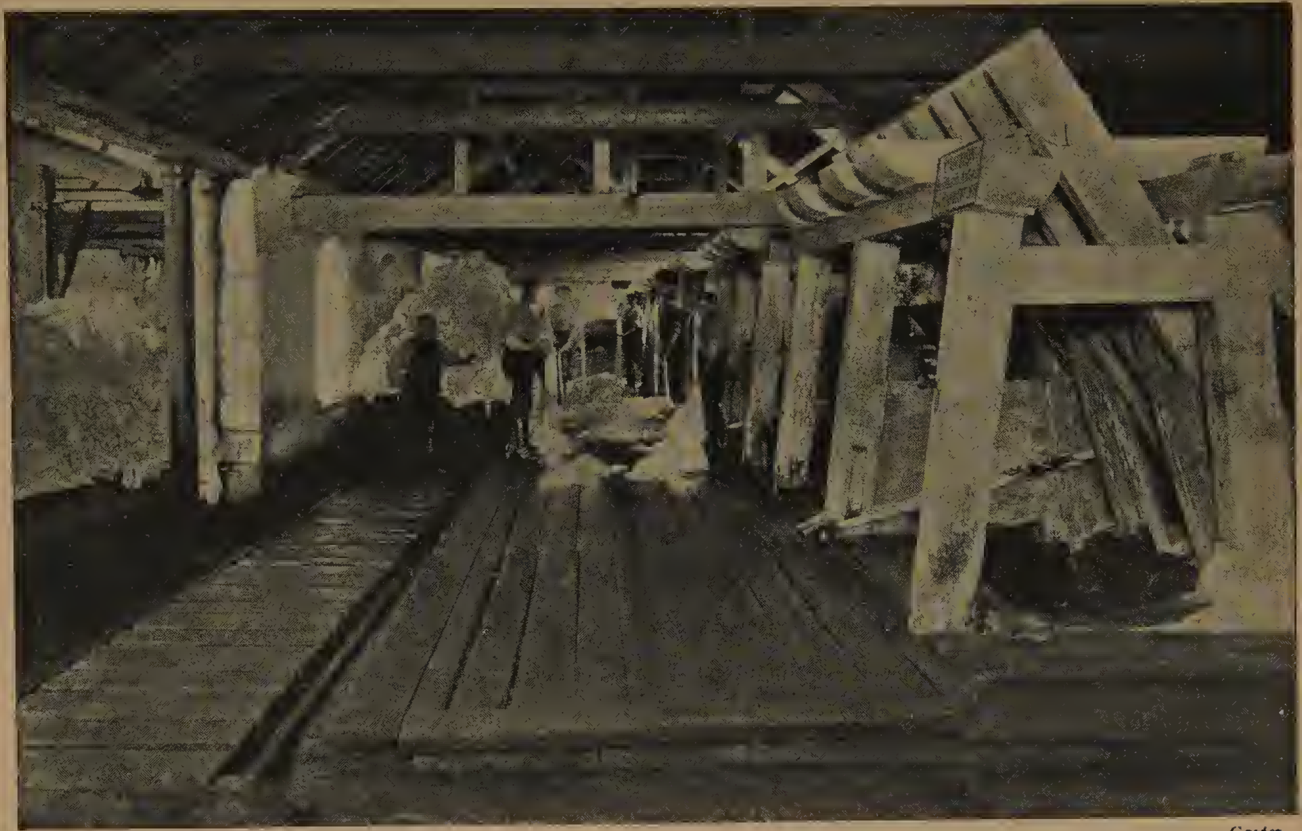


Photo by Carter

WASH MILLS IN LINEN BLEACHING

was called " she," because of its being so hard to bring to the right point.

While bleaching is the work proper at the bleach greens, here, also, is usually performed another stage in the perfection of linen.

Finishing

When the linen is quite white it is starched, and afterwards dried on steam-heated rollers and is then ready for the " finishing " process. The webs are once again stitched together, and the process of finishing begins : The cloth is breadthed, passed through a water mangle between rollers which leave just the proper moisture for taking starch, then into and through a tank filled with a mixture of blue and starch, after which it is passed over heated rollers to dry it. The webs are once more unsewn ; they are put on the beetling beams and beetled for four or five hours, and so on until they have had thirty to sixty hours of beetling. They are then aired, stretched to the full width, and calendered. Damasks and many fine linens for export receive a very high finish, or glaze, which prevents them looking rough ; but if the linen is soon to be in the hands of needlewomen, this glaze is worse than useless. With respect to finish, I may mention what is called the patent finish. The linens are placed on frames in a stove-house, through which a current of air is kept passing, and are carefully stretched and gently handled. The result is a nice, open, clear finish, very agreeable to the eye, and—to some extent—very like the ordinary finish of linen pocket handkerchiefs. Indeed, the handkerchiefs undergo a very similar process in the stove-house. So high a reputation has been earned by the Ulster bleachers, that their machinery has been adapted for cotton goods and large quantities of cotton material are shipped from

Manchester to Ireland every week for finishing. It is dyed, finished, and put up ready for shipment and returned to the manufacturer in Manchester.

PRINTING AND DYEING

A large quantity of low-priced linen is exported brown as received from the looms; another class is slightly tinged yellow by steeping in dilute chloride of tin and catechu, and then finished or glazed by the beetling process already described. The former are technically called "rough browns," and are, I believe, used for blouses. The latter styled "hollands" are much used for window-blinds; but, in addition to yellow holland, we hear of "slate holland," "blay," "drab," and "black" ditto. I need scarcely explain that the first of these only resembles slate in colour, and this colour is attained by dyeing the cloth in the ordinary way.

The dyeing or printing of linens is, to use the words of Dr. Ure, "a chemical art." A very important part of the process is the correct application of the mordants, or, as he explains, "the substances which are used, previously applied to piece goods, in order that they may take afterwards a required tinge or dye." Of course, if the mordants be universally applied over the whole cloth, and if it afterwards is plunged into the dye, an even colour will result. While, if the mordant is only applied to portions of the cloth, an uneven colour or pattern will come out. The latter operation is called "printing," the former simply "dyeing."

The printing of cotton or calico has been so universally described that we need not enter into any general account of this chemical art. It will be sufficient to limit our observations to the details that are specially remarkable in its application to the linen manufacture.

So long as ninety years ago there existed in the north of Ireland a few small printers, who operated on the home-made fabrics of the farmers, and produced, with merely common indigo, an old-fashioned pattern of blue ground with a white spot. This pattern was a favourite with the country girls, and was greatly in vogue in those days, before cheap calico dresses had been introduced. The printing of linen did not, however, develop very greatly until during the latter half of the last century. It is certainly not so cheap and expeditious as cotton printing, the increase being due to, first, the greater cost of preparatory bleaching ; next, the greater difficulty of applying the madder dye, the flax fibre being harder and not so absorbent as cotton. Then the cost is greater of finishing with the beetles, or special patent machines, instead of the simple pressure through a calender.

Although printed linens cannot be sold at so low a figure as cotton, still their worth is far superior. Thus linen dresses will wash up well over and over again, and retain the silvery brilliance of the original colour, while it is generally found that the white ground in the cotton fabric soon loses its original purity and assumes more or less of a yellow tinge. The flaxen fabric, also, possesses much greater durability. Owing to this fact, it is the custom to use almost entirely *permanent colours* in printing linen, the article being too valuable to place on it the common *fugitive* colours from ordinary pigments put on low calicos. Then another great advantage is that there is less danger from fire, for, unlike cotton, the flax fabric is safe comparatively, being very slow to ignite. Within the last decade producing coloured linen has increased enormously. So much so, that a leading Irish firm catalogues eighty different shades of coloured dress linens, while it is computed that probably over 3,000 looms are working in this line.

On visiting premises where linen printing is carried on, there is seen usually some bleaching machinery, as the linens have first to undergo that process. It is, however, a common practice for bleachers to whiten the goods and send them thus to the print works ready for immediate use.

There are two ways of impressing the pattern on the goods—the one by blocks of wood, called block printing ; the other by copper rollers. The pattern, after first being sketched on paper, is transferred to the smooth surface of these wooden blocks, which to ensure permanent evenness, are made of four pieces of wood glued together and arranged to prevent any warping or crookedness. The pattern being nicely developed on the smooth face, the next point is to arrange it for the stamping process. A few stamps are still made by cutting away the wood and having the pattern somewhat like common printing type, but the modern method is to work up the pattern in copper. The operation requires great skill of hand and a nice eye. Copper wire beaten out flat is set in to represent lines, and small pins of copper are driven in to bring out the minute portions. It certainly requires men of considerable taste and education to originate new patterns and so good salaries are offered.

The block will be probably nine inches square, and when ready for use the next thing is to prepare and apply the mordant. This is done by mixing it up with starch or gum to give consistency, and it is then stamped on white linen on a pad covered with soft material. After the pattern is impressed the goods are taken to a dry room called the "ageing room," and retained there from two to five days to ripen or set the mordant ;

black and chocolate requiring double the time of the reds and pinks. From this room the goods descend to another to be immersed in a strange-smelling fluid, and after being passed over by rollers the cloth is well washed and the gum or starch of the mordant is then quite extracted. The cloth is now ready for the madder-dye bath, where it is detained about two and a half hours, revolving on rollers. It is next washed by machinery, then twice soaped and washed again ; plunged in a weak bath of salt, washed, starched, and finished—either by beetles or by the process, same as bleached linens. The printing by rollers is, of course, more rapid than by blocks but does not suit always. The pattern is cut out of the copper roller like a seal, directly opposite in principle to the block cutting which stands up like type. The cloth is passed through the mordant stuff and over the rollers, thence to hot cylinders for drying. For the rest of the process it is similar to that of block printing. Four colours can be put at once on the machines, each colour simply requiring a separate roller. In fact, as many as twelve colours could be put on if required, so that by this system the saving of time is very considerable. Printing in one uniform colour is called "padding." At any rate our linen is now like—well, just like linen in its finished state.

CHAPTER X

VARIETIES OF LINEN

When linen goods are received by the merchant from the bleaching works in the finished state they are carefully examined and any defective portions laid aside. Then they are placed in cool storerooms and are kept there till required in the uniform and simple fold the last process gives them. They are next carefully measured—which is done by machines. After this, the skill of the "lapper," as he is called in the trade, comes into play, and produces the marvellous tucks and folds which distinguish some of the pieces, especially for foreign shipment, so puzzling to the uninitiated. To attempt to open out one of these pieces and replace it in its original folds would be a sheer impossibility except to a trained hand. In most of the English-speaking markets greater simplicity in this respect is being called for from year to year, and many firms now get their goods in a plain roll, which is more convenient for the retailer to handle. However, nothing is more remarkable in the linen trade than the enormous multiplicity of widths, qualities, and textures which are required by the different markets of the world. One man in his time plays many parts, as Shakespeare declared, and this is no less true of a piece of linen. The same width and quality which goes in one fold to London may go under another name and make-up to Paris, and under still another to New York, while the make-up for the West Indian and South American markets is so widely different that one could scarcely recognise the cloth as the same quality which has been made up for the other markets mentioned. But although the material itself may be in all respects the same, the lapping, the folding, or the boxing will indicate to the man who knows the particular market the goods are for. There must be a great deal of conservatism in human nature, judging by the way in which each market sticks tenaciously to the variety of fold and make-up to which it has been accustomed, and a Belfast merchant might as well be prepared to job his goods out at a sacrifice price as to send them to New York in the Brazilian fold and make-up, or to Paris in the New York fold. However, elaborate folding and costly ornamentation, once so common, are now fast disappearing.

Linen Cambrics

The names given to various peculiar styles of finish, etc., in linen goods, were originally taken from some country or district once celebrated for this peculiarity of style. This origin became in time forgotten and the name then became a generic name for a certain class. The name, "Silesia legitima," stamped on goods intended for the Brazilian market, might puzzle the observer until he is told that "Silesia" is given to a peculiar fold and finish; and the word "legitima" means real linen, and not mixed with cotton—a guarantee foreigners generally looked for. In the same way "Cambray," a manufacturing town in Flanders, was the origin of the word "cambrics"—a class of fine handkerchiefs now largely produced in the vicinity of Lurgan, county Armagh. And in this connection it is of note to know that in 1814 the article of linen cambric was much more expensive than the richest silk. In the earlier times of the Irish cambric trade, the manufacturers had hosts of difficulties to battle against; but, as in all other cases where the legitimate spirit of enterprise gets fair play, these obstacles only tended to excite a

Photo by Welch

FINISHING AND ORNAMENTING LINEN

corresponding amount of perseverance which ultimately led to the most triumphant results.

The amount of business done for some years past in the manufacture, finish, and sale of cambric handkerchiefs for the New York and London markets seems almost incredible. In fact, special figures are given in the Board of Trade returns, and thus while U.S.A. imported handkerchiefs value £438,750 during one single year (1912), the amount was even higher in 1911 at £517,500 and £527,291 in 1910, while it was a record at £557,500 for 1906. What becomes of all these handkerchiefs ?

Though this cambric fabric is chiefly used in handkerchiefs it also is used in many other forms, such as ladies' dresses, etc. In this connection it may be stated that there are three large bleaching concerns, near Belfast, where there are usually about 600 girls constantly employed, and earning good wages, in the department connected with finishing cambric handkerchiefs. Increased facilities of manufacture has cheapened the prices and so raised the average demand for that class of goods, that the ratio of employment has advanced 500 per cent.

Besides cambrics there are also damasks and diapers. Then a certain unglazed rough finish for linens is called "Courtrai finish"; another, quite different, is called "French finish"—originally, no doubt, derived from these countries, much in the same way as we say French beans, Hessian boots, or German silver. In some time, probably, this connection with the original localities will be so completely forgotten that these names are incorporated into our ordinary conversation.

The Making of Unions

Linen manufacturers ought, of course, to manufacture nothing but linen goods. Unfortunately the stress of circumstances forces them to extend their manufactures to Unions, that is, goods into which enter *both* linen and cotton yarn. In order to satisfy and meet, as far as possible, a craving on the part of buyers for low-priced goods having some appearance of linen, this has long been found necessary. The making of Unions is justified in the case of fancy dress goods, as undoubtedly cotton takes and holds dye stuffs better than linen, the fibre of it being softer and more penetrable. Very beautiful and very becoming dresses are being woven in such Unions.

Apropos of the class of goods known as "Unions" it is strange to imagine that their introduction in 1828 created great excitement and indignation since the mixed fabric of cotton warp and linen weft was surreptitiously sold as genuine linen. Many meetings were held to denounce this novel manufacture, to distinguish them from pure linens—in fact, asking for an enactment not unlike the present law regarding coffee and chicory, which prohibits the mixture being sold without a proper label describing the combination or union. All respectable manufacturers would, of course, mark their goods as cotton and linen unions; but even at the present day several shopkeepers in London and in the other large cities of England are not very particular in this respect. Thus too frequently goods half cotton, or merely linen faced, are passed off as linen to the detriment of the producer and buyer as well as the reputation of Irish linens. The vigilance of the Government Inspector in detecting such frauds and prosecuting the offenders is distinctly praiseworthy, but the fines inflicted are much too lenient, considering the unblushing wholesale immensity of the fraudulent practice.

There is a correlation as well as a contest always between the sister industries of linen and cotton. As compared with linen, the cotton industry is only a juvenile. It is only within the last 100 or 150 years, by the invention of the spinning-jenny, the power loom, and the flying shuttle, that cotton has really come into common use, and that its industry has assumed the gigantic proportions of to-day. The linen merchant now meets it as an opponent at every turn, and he is so hedged in by it that the linen industry has been barely able to avoid a serious contraction.

Cotton, a Fierce Competitor

Among the reasons why cotton is so formidable a competitor of linen the following may be mentioned. Although the cost of flax and of raw cotton do not differ very much, cotton has a great advantage over flax in the ease and cheapness with which it is manufactured. In the first place, the hard and inelastic nature of the flax fibre makes a much more expensive type of machinery necessary for its spinning. A cotton mill can be erected complete for about 27s. 6d. a spindle, whereas a flax-spinning mill would cost from £6 to £8 per spindle. Then the great variations produced in any one field of flax necessitate elaborate and costly hackling and sorting, in which about 50 per cent. of it becomes tow of comparatively low value, raising the cost of dressed flax fully 50 per cent. above that of raw flax. Cotton, on the other hand, is very uniform in quality, and is cheaply carded, with little loss of material or of weight. Its elasticity allows of the employment of machinery so largely automatic that the number of workers in a cotton mill would be about one-quarter of those in a flax mill of the same number of spindles, while at the same time the turn-off of a cotton spindle is considerably greater than that of a flax spindle.

The advantage in favour of cotton does not end with its conversion into yarn, for it is more easily woven than linen, and finally, it is bleached more quickly, with less risk of damage and less loss of weight. So closely correlated are cotton and linen that a serious advance in price of the finished cotton goods is always accompanied by an important increase in demand for similar linen articles, since buyers prefer linen when the difference in price is comparatively little. Nothing but the inherent beauty and excellence of the flax fibre has permitted its survival of competition so formidable.

HOW TO DISTINGUISH LINEN

It may be asked by those who are not *au fait* in the technicalities of linen manufacture how the ordinary buyer may readily recognise a textile as linen, apart from its admixture of cotton in the form of a union. The simplest test, perhaps, is to separate the threads in a small fragment of the cloth of about two inches square. Then taking a thread of the warp, *i.e.*, the lengthwise running threads, apply a burning match to it. If it is cotton it will blaze up readily and continue to burn. Whereas if it is flax, it will smoulder rather and burn brittle. This is one sure test, even though it be rough and ready.

CHAPTER XI

GRADING OF LINEN

Linen cloth is regulated as to fineness by different scales. The ordinary scale is 40 inches, and according to the threads used in that space the fineness is determined. However, by one of those curious perversities so common in trade names, the linen is called not by the actual number of threads in the 40 inches, but by the number of bars or reeds through which the warp passes. Now, the warp threads do not go through these reeds singly, but two through each opening. Consequently a web called a 10°° is in strict reality a 20°°. That is, there are 2,000 yarns in 40 inches wide of the warp before it receives the weft. In the weaving the width of 40 inches is reduced to 38, and in the bleaching process this is generally again reduced to 36.

Let us, for example, take a piece of the so-called yard-wide brown cloth, styled a 15°°, and it will count 15 threads of warp under what is called a 38-inch glass. Let us count how many threads are in one inch. We will find them amount, as near as possible, to 79. And the web measuring 38 inches wide, so $79 \times 38 = 3{,}002$. The total threads in the width is just 3,000, but the reed used has only half as many openings, and the cloth being called after the reed is styled a 15°°. Suppose this web to be bleached, and to measure 36 inches, it would contain about 83½ threads to one inch, as $83\frac{1}{2} \times 36 = 3{,}006$, the exact number being 3,000. The warp in loom should therefore be counted before weaving by a 40-inch scale glass, after weaving by 38-inch glass, and bleached by 36-inch.

But although this is the ordinary scale to calculate by, different counties in Ulster have adopted different scales. About Ballymena, County Antrim, the scale used is 36 instead of 40: consequently as 36 is to 40 so is the fineness, or set, or count of yarns there to the ordinary standard. Thus Ballymena 9°° is equal to ordinary 10°°, for as 36 is to 40 so is 9 to 10. Broad sheetings are also made on this 36-inch scale.

The construction of the glasses I have referred to is not generally understood, even by parties in the linen trade. If, however, we study the facts just given, the following proportions required in these counting glasses will be apparent.

THE CORRECT WAY TO RECKON FINENESS

would be by the number of threads per inch in a warp of the cloth. But by custom it is the fineness of the reed that is adopted, this being half the number of threads, as already explained; the glass instead of being 100th part of 40 inches, is made $\frac{1}{200}$th part of 40 inches. For example: take a web with 2,000 threads in the 40 inches, the reed has only 1,000 openings, and the web is styled a 10°°. A magnifying glass with an aperture below must, in order to be a 40-inch glass, be had to count 10, *i.e.*, $\frac{1}{200}$th part of 40 inches, which is 0·20, or $\frac{20}{100}$th, or $\frac{1}{5}$ of an inch.

A 38-inch glass is 0·19, or $\frac{19}{100}$ths of an inch.
A 37-inch glass is 0·185, or $\frac{18}{100}$ths ditto.
A 36-inch glass is 0·18, or $\frac{18}{100}$ths ditto.

With this information before us, anyone can easily test for himself the accuracy of the counting glasses offered for sale.

SOME TECHNICAL NAMES

The technical names given to the warp reeds are, 40 threads or 20 splits equal to one "beer," and five "beers" make one set or hundred (splits). As the term hank and spangle may not be known to all readers, especially in their application to spun yarn, it may be stated that after the yarn is spun it is wound off the spool on a reel, constructed so as to measure exactly 90 inches in circumference. Every " hank " contains a dozen " cuts," each cut is 120 rounds of the reel, and four hanks were counted as a spangle. A very marked difference exists in the relative counts in linen and cotton yarn, and this has become a still greater puzzle to many manufacturers, since the use of mill-spun yarn has superseded that of hand-spun. As an instance of the difference in the counts of linen and cotton we may take, for example, linen yarn of the degree of fineness of 20 lea—that is 20 leas to the lb. which is just equal to cotton No. 7, the length of each lea of linen yarn being only 300 yards, while the hank of cotton is 840 yards. Linen yarn of 60 lea would run with cotton yarn of No. 22, and 40's of the latter would range with 110 lea.

The term " lea " came in with the introduction of linen yarn spinning by mechanical power. In the day when the hand-wheel was the sole machine used for the production of yarn in Ireland, the article was measured by the hank, and by that mode of counting all such sales were made.

Testing House

In response to a request made by manufacturers in the textile trades of Belfast and district, a public Textile Testing and Conditioning House has been established in the Municipal Technical Institute, Belfast. This house has been established with the approval of the Department of Agriculture and Technical Instruction for Ireland, and is carried on under the auspices of the Belfast Corporation. The functions of the testing

TEXTILE TESTING ROOM
Belfast Municipal Technical Institute

house are similar to those of any other public textile testing and conditioning house, namely, the examination of flax and other textile materials with a view to ascertaining and certifying their true weight, length, condition, and strength, and, in addition, the carrying out of such other tests and investigations as may be required in order that spinners, manufacturers, merchants, and others desirous of having tests conducted and an official certificate issued, may effect their object through the medium of an independent public authority.

The strictest secrecy is observed with regard to all work sent to the testing house; as a consequence the house is not open to public inspection. Now textile materials lose or gain in weight according to the temperature and humidity of the atmosphere in which they are stored, and the conditioning houses certify what the condition was at the time of delivery, so as to avoid dispute caused by excessive moisture present when the goods arrive at a possibly distant destination. Conditioning houses are primarily for the conditioning of yarns, but they fulfil other functions. Yarns are reeled to determine the reality of their marked number or count, and are examined for twist and tested for strength. Piece goods are measured and analysed and their strength tested. What is one party's gain is another's loss, and testing houses are less used than they might be in matters affecting only home or local trade. For their own personal satisfaction spinners are accustomed to make their testings on apparatus of their own, but to carry conviction to others it is necessary to have independent tests.

CHAPTER XII

MAKING UP AND MARKETING

It is true that we now see our linen folded carefully and ready for export to the other end of the world maybe. However, it is not in this form that the great bulk of linen leaves the linen merchants. In our case we set out definitely to trace the apotheosis of a handkerchief. So we follow the cloth across to another huge warehouse, which seems large enough by itself for the whole operations of any ordinary firm, but which—as in the case of York Street Company—is given up entirely to one department only for the production of handkerchiefs and other sewn and embroidered articles. First, in the cutting room we see how the handkerchief begins its existence as a separate entity by being cut from the web. The same process is gone through in the case of a collar, a pair of cuffs, a shirt, or any other article or garment. From the cutting department its next ordeal is to pass into the hands of the hemstitchers.

If the handkerchief is a plain one without any ornamentation, we have now almost reached the end of its history. Its penultimate stage is to pass into a machine which punches the holes and stitches down the hem at one operation. Let us suppose, however, that it is one of the elegant embroidered *mouchoirs* so highly esteemed by the ladies of high society; then back again it goes from the city factory to revisit once more the scenes of rural bliss. Week by week to the factory—or its agency—come hundreds of women outworkers—youthful, middle-aged, and old—to fetch handkerchiefs, tea-cloths, bedspreads, curtains, robes, blouses, etc., which require to be embroidered and have lace inserted. In their cottages this work is done, and next week they will return them with the necessary embroidering, or drawn thread ornamentation, completed when the farmer's cart—their own or that of a kindly neighbour—is coming to market. So our handkerchief has now returned to the factory beautifully embroidered by its country jaunt.

The handkerchief looks a little bit limp and crushed after its embroidery operation. But the fatigue is only temporary. Up in the washing department a white-aproned maid receives it tenderly. So into the bath it goes, and no bath attendant could be more scrupulously careful in looking after her charge. Out of the bath into the drying closet it progresses; and then, to assume the stiffness of pride befitting the dignity of an embroidered handkerchief of the best flax ancestry, enters the ironing department. Surely never handkerchief ever underwent such toilette as this. But the end is now in view. Away in the boxing-room tasteful hands have prepared a dainty morocco travelling casket which will just accommodate our handkerchief and five companions as like each other as can be. A blue ribbon gives the finishing touch, and to-morrow the soul of the pretty blue-flowered flax plant we saw growing in an Ulster field is on its way to down-under Melbourne or far eastern Japan. We might have traced the history of a collar, a serviette, or a tablecloth for that matter. Their development is akin to that of the handkerchief. This is the work that goes on every day in Ulster that the world may have its linen, and though other countries try hard to rob Ireland of the honour of being the linen centre of the earth, not one of its competitors can turn out linen so well, so cheaply, and so beautiful.

MARKET DISTRIBUTION

In earlier chapters I showed how flax is brought into the markets, and how at one time there were linen halls in both Belfast and Dublin for the meeting of buyers and sellers of the finished article. These latter institutions have, however, become merely as "things that were," for while the old Brown Linen Hall in Belfast still exists, but utilised, alas, only as a repository for the empty packing cases of adjoining merchants in Donegal Street, even its successor, the White Linen Hall, is long ago razed to the ground and on its site stands Belfast's beautiful Municipal Palace. Then within late years was tried the utilisation of the Ulster Hall as a linen exchange, but only to prove a fatuous experiment which did not survive many months. However, any fine forenoon the uninitiated passenger in Bedford Street, Belfast, may observe little knots of businesss men standing on the side walk, and if his hearing is acute he may overhear scraps of their conversation sufficient to indicate that it is concerning yarn and linen—for the entire district hereabouts, with its myriad of stately warehouses and factories, has the individualistic linen atmosphere. It is the nearest approach to an exchange. The concourse cannot in any way, either in respect of numbers or activity, be comparable to the cotton or corn exchanges in their centres, and now the ubiquitous telephone tends to make the linen exchange a misnomer and an anachronism. *Tempora mutantur*, etc.

Great changes have taken place during the last forty years in the methods of selling the products of flax, the tendency being to eliminate the middleman. Formerly spinning was the sole business of a firm, whose yarns, through one or more intermediaries, reached the weaver. Weaving was the sole business of another firm, whose goods were sold to the merchant through another intermediary. Bleaching was the business of a third. The goods were then sold to a merchant who sold to the wholesale houses either at home or abroad, and these sold to the shops. But now two or more of these operations are the business of one firm and, it must be conceded, it performs the duties involved with much success.

We often hear of the supineness of the British manufacturer and his unwillingness to go after trade which he expects rather to come to him. It is also a favourite reiteration in consular reports that the British manufacturer insists on quoting only English prices, and will not trouble to learn the language of the country with which he wishes to do business. This charge can certainly not be made against the up-to-date and thoroughly alert Irish linen firms. They have their own travellers or direct representatives in all markets, speaking the languages of the countries where they go, selling direct to the wholesale houses abroad, and even in some instances to the shops—selling them what they require in the currency of the country. A letter addressed to an Irish firm in any language will be understood and immediately replied to in the same.

Misleading statements are often made for political purposes to the effect that the Irish linen industry owes its present strong position and world-wide renown to its having been artificially fostered by Government and fed by bounties. This was, no doubt, true to some extent in ancient days, but seeing that the bounties and all Government support ceased 100 years ago, before the introduction of steam power or any of the modern methods of production and distribution, it may be fairly claimed that the success is rather due to the innate perseverance and capacity of those engaged in the north of Ireland linen trade. The merchants of Ulster are inferior to none in the Empire in energy and business-like habits. They require no special stimulus to urge them forward, but will, doubtless, uphold the supremacy they have already obtained. The only difficulty that meets them of any importance, is the range of hostile tariffs, and a somewhat serious difficulty this is at times.

To compete with foreign producers in a foreign country would be something like approaching an even struggle, if the British merchant had only to overcome the disadvantages of distance, viz., freight and carriage with the attendant risks, but when added thereto a duty of 20, 30, or 40 per cent. must be paid, the struggle appears a hopeless one. And yet the perfection of the Irish linen manufacture is so great—despite the observance of a good standard of wages—that even these exhorbitant protection duties are frequently paid to obtain the goods by people in countries guarded by very high protective tariffs.

CHAPTER XIII

CONDITIONS OF WORK

DESPITE various disadvantages inseparable in certain processes of the preparation of flax into the finished product the conditions of labour are, on the whole, good and favourable to the health of the worker. The modern millowners are humane and fully cognisant of the fact that the health of their employees is synonymous with their efficiency and so must be safeguarded mutually. According to the ideas which are entertained, even to this day, in some quarters respecting the mill-owner, it would almost seem as if Nature, in one of her freaks, had got up peculiar descriptions of humanity for that special order of things, and that in many cases the proprietors of factories were merely superior samples of the genus Legree, as pictured by Mrs. Beecher Stowe in *Uncle Tom's Cabin.* These " dealers in white slaves," as certain sensationalists have tried to designate them, are described as being very greedy, and especially grasping in disposition, and—except so far as the workers contribute towards their wealth—caring no more for the comfort and welfare of those people than the planter of Peru cares for the poor Indians who toil in his rubber forests.

On the other hand, the factory operative is supposed, by his long contact with a heated atmosphere, his gregarious habits and artificial mode of life, to have become the very type of discontent and intemperance, unhealthy in body, corrupted in mind, and ever plotting against the interests of his employer. Nothing can be more unjust to both parties than such slanderous statements. In real life, factory-owners, like other men who have great capital at stake, are, of course, anxious to make the utmost amount of profit out of their investment, but that, as a class, they are either over-exacting or uncharitable in their intercourse with the operatives is the veriest libel. It would be well for some of those writers in alarmist newspapers and ranting demagogues of the street corners, who have borne evil testimony on this subject, to spend a few days in the vicinity of some of the large mills in Ulster, and there see for themselves what are the real relationships that exist between masters and men.

They would soon find that in the everyday lives of the people in the linen industry there are conditions similar to those marking other sections of workers. As regards housing, the linen worker of Ulster is much better provided for than is the English or Scotch cotton operative and coal miner. With exception of Belfast, the houses are not thickly massed together, and in almost every instance each inhabitant has his, or her, own cottage—the tenement idea being almost unknown. The tendency for a couple of decades back has been to provide in the vicinity of the mills cottages, which are really models of that style of dwelling. The mere outward appearance of these habitations exhibits at once the blessings of comfort and cleanliness. Most of the workers have little gardens which, during the intermediate hours of labour, they cultivate with a spirit of gratified ownership which not only brings satisfaction and contentment, but also gives greater spirit and energy for the pursuit of toil in the mills. This restful recreation has other and still higher results. It binds the worker to his home, and cherishes within him that love of the beautiful which rarely fails to purify the whole existence of its possessor. Gratifying, indeed, is the fact that in such localities drunkenness is noticeably absent, and the people in general seem to enjoy a good share of the comforts of existence.

A very short sojourn at any County Court House during an Assize week, and a close examination of the peculiar cases that may be tried, will convince any doubter that, compared with the big bulk so employed, the linen operative is the exception rather than the rule to be in the dock.

A Generous Action

Neither is it a fact that there is much dissatisfaction between workers and employers in Ireland's textile trade. The relations are always decidedly friendly and the law of kindness so regularly exercised on one side is fully reciprocated on the other. A somewhat recent action of the united body of flax spinners is, I think, worthy of being recorded to their credit. In 1908, during a period of unexampled dullness and depression, those masters discovered that, although they had for some months been running their mills two-thirds time in order to lessen production, their stocks continued to rise. So they resolved in June of that year to reduce still further production by five hours a week. At the same time, however, they agreed to make no further reduction in the wages of the women and young people employed by them. And this payment of unearned wages for five hours a week continued for seven months in all. I have never heard of a similar act elsewhere. In 1906–7 spinners' wages had been advanced by 20 per cent. Therefore a woman who before 1906 had been earning 10s. a week of 55 hours was temporarily, in the time of stress, paid 8s. per week of 32 hours.

Healthful Improvements

The tendency is always to promote any improvements that may ameliorate the conditions under which the operatives work in the spinning mills and weaving factories. Chief among these is the diminution which has been effected in the amount of dust floating in the air of many of the rooms. So the first distinct step in clearing the dust out of the dusty rooms was to collect the dust as near as possible to the point at which it is produced, and the principle has been gradually applied, beginning with the worst places in the mill. The final result might almost be described as a revolution, so marked is the improvement in the atmosphere compared with what was looked upon as the normal and inevitably dusty condition of these rooms twenty years ago. Reference has already been made to the patent automatic-screwing hackling machines and their wonderful work. One great advantage of this machine is that the boys who feed it are all stationed at one side only, and, in consequence, by strong ventilators the dust can be driven clear away from the operatives. As this dust is, in the smallest quantity, disagreeable, and when heavy deleterious, labour-saving is not the only advantage of this type of machine.

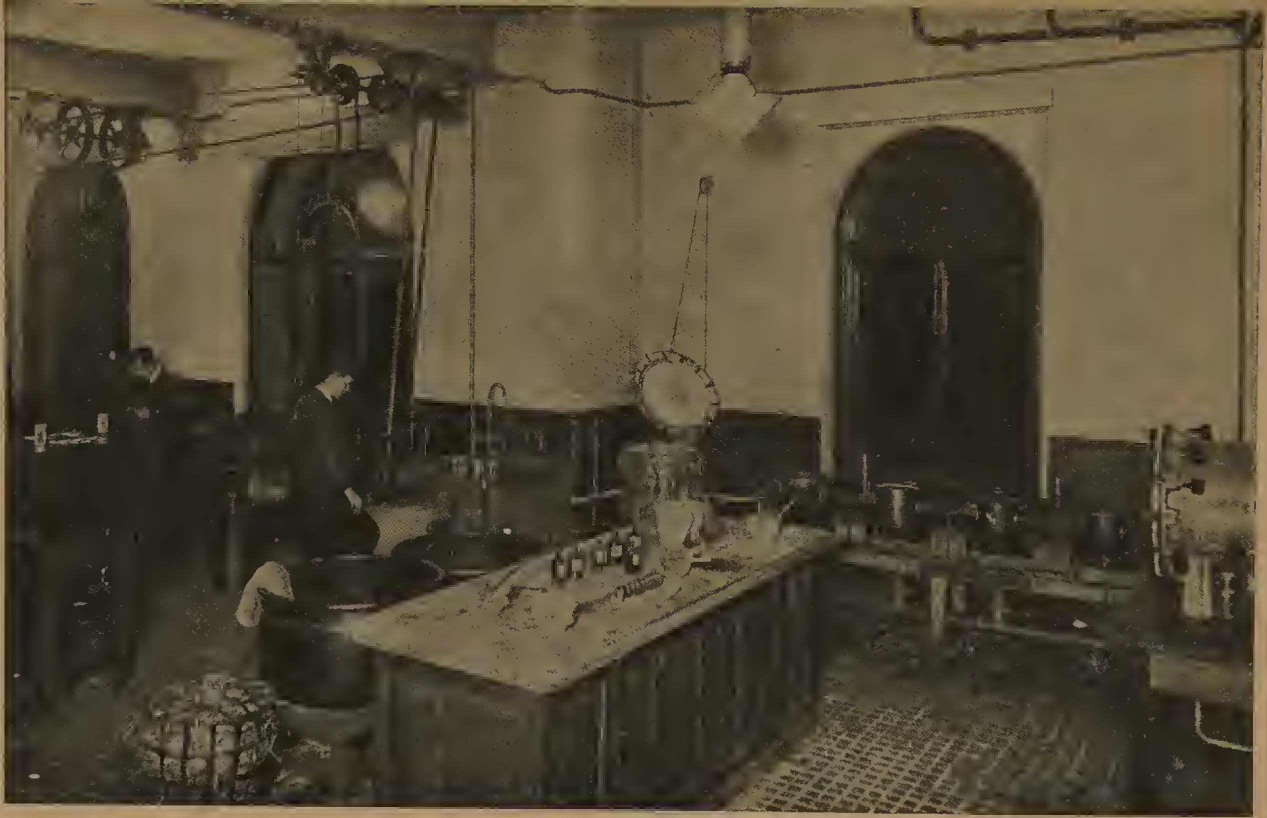
In the wet spinning-rooms close attention to the design and condition of the trough lids, coupled with better covering of steam pipes and general exhaust ventilation, has greatly reduced the excessive heat and moisture of the rooms, and brought the latter well within the limits imposed by the Home Office. In weaving sheds, the better distribution and more extensive application of ventilation and exhaust appliances to satisfy the standard of air purity required by the Home Office has likewise improved the conditions there, though to a less marked degree than in the spinning. In 1856 there was an agitation calling for bleach works to be put under the Factory Acts and the report of

Mr. H. S. Tremenheere, a gentleman sent as Commissioner from Parliament at Lord Shaftesbury's desire, is as interesting now as it was then. He found very little to say against those in Ireland. In fact, out of forty-seven works, I believe, he could only find one open to censure, yet he recommended they should be placed under these Acts with the cotton bleach works of Lancashire. The bleaching of linen is, perhaps, the healthiest employment in the world—even the Select Committee of the House of Commons declared it so—and the men engaged often reach a great age.

Parliament in passing the Handloom Weavers' Protection Act, which came into operation on 1st January, 1910, has made an effort to revive the hand-weaving of damasks, cambrics, and diapers, and those engaged in that branch of the industry are laudably striving to take advantage of it. A few years will tell whether or not it will have the desired effect. Another recent Act of Parliament is unintentionally operating to the reduction of hand-weaving, as many old people still able to weave a little have abandoned that work on getting their old age pensions.

Technical Education

It is good to know, also, that the employers, fully alive to the importance of the industry, are doing their utmost that the workers may be thoroughly awake and equal to the necessities of the industry and its improvement wherever possible. Undoubtedly the progress made in technical education is bound to have its good effects as years go on, not alone in larger production, in newer and more specialised methods and machinery, but also in the more artistic class of productions. In the Belfast Municipal Technical Institute —one of the very foremost in the Kingdom for all-round



DYE LABORATORY
Belfast Municipal Technical Institute

equipment—there is a special textile department conducted by Prof. Bradbury and a staff of twelve competent teachers—providing courses of instruction in as many sections of the textile industry as possible, due regard being paid to the attainment of efficiency and the avoidance of overlapping. This department, attended by large numbers of students, has already enabled many to obtain important managerial positions. The courses of instruction are most thorough and comprehensive, embracing the theory and practice of preparing and spinning flax yarns, the designing, costing, and manufacturing of all classes of linen goods, etc., and the construction and tuning of their respective kinds of textile machinery.

Every effort is made to impart the practical knowledge so essential for those who desire to take up positions of responsibility in mills, factories, and office. The machinery is very extensive and of all types, while each student is also expected to prepare designs which he must peg or cut, lace, weave, and mount, and to record patterns of his own manufacture under the direction of the head of the department and assistants. Reading maketh a full man, and when to it is added the practical work of everyday life it must be concluded that this Technical Institute is a power for good in the prosperous furtherance of the Irish linen industry. In co-ordination also with the textile department's curriculum there is also special instruction provided for damask and general textile designing as well as for the study of the chemical treatment of flax and other textiles in bleaching, dyeing, and finishing. Moreover, to induce students to pursue these important studies one big linen manufacturing company offers attractive facilities, which take the form of payment of students, no matter what firm they are connected with, to all classes attended at the Technical Institute, and in the case of students coming from a distance, very liberal assistance towards the payment of their fares. With the royal road to knowledge so smoothed and widened there is every opportunity for the poorest operative to rise in time to become a Prince of Commerce, or at least assume a highly-paid managerial position. So mote it be.

CHAPTER XIV

COMBINATION AND WAGES

THE relations between masters and workers in the linen industry are of a distinctly friendly character. In many instances one generation is succeeded by its descendants, and sometimes to the third or fourth generation, in the service of the same company. Conferences in an amicable spirit have sometimes taken place and arrangements of wages been agreed upon without recourse to strikes. In fact, labour disturbances of any consequence have been exceedingly rare in the linen industry and always local rather than general in dimensions. It is not to be expected that among so many young women who, with children, form a large part of the workers, that trade unionism should flourish. Nor does the distribution of the linen manufacture favour too much the combination of the operatives. The linen industry is carried on mainly by groups of workers of different grades, engaged at different tasks, and living at considerable distances from the similar groups employed elsewhere. Where the industry is most centred, and where men are employed in comparatively large masses—as in Belfast and the chief towns of Ulster—the unions are strongest in numbers and activity.

WORKERS' TRADE UNIONS

However, by no possible stretch of imagination can it be written that those engaged in the linen industry are organised at all proportionate in strength to the vast community employed, nor in comparison with the organisation of workers employed in the sister manufactures of cotton and wool. The fact that there are less than 6,000 operatives in all enrolled in the various textile trade union societies reveals a want somewhere. But it must be remembered that militating against a very strong force of trade unionism are very great factors. The first of these inimical agencies is that the big majority of the workers are females and many of them look at the work as merely transitory, leading, perhaps, to matrimony. Moreover, there is the great obstacle of social inequalities and individual dissensions always in the case of women workers. It must not be forgotten either, that a very large proportion of them would be taxed very heavily to pay the small weekly membership subscription from wages already scant and depleted by fines. But greater against the success of textile trade unionism is the fact that in no part of the world is political and religious sectarianism waged more keenly, and so even self-protective measures, as represented by trade unionism, are weakened by the rancour of the dissensions and the antipathy to each other of the several cliques.

The present organisations of the linen operatives are: (1) Textile Operatives Society of Ireland with about 2,500 members—both males and females; (2) Flax Dressers' Trade Union, founded in 1872, and having 1,267 members; (3) Flax Roughers and Yarn Spinners Trade Union with about 1,100 members of both sexes; (4) Power Loom Tenters' Association comprising upwards of 500 members.

Coming to the question of grievances—though this is not the only *raison d'être* of trade unions—it is undoubted that there are such, especially with the weavers. They must suffer alike for the faults due to badly prepared yarn, and to imperfections of the loom machinery through neglect on the part of the tenters. I have been shown the weekly wages card of one weaver —a man with thirty years' experience—and while the gross earnings were 12s. for the week's work, he had to suffer deductions from this sum of 3s. 6d., viz., 3s. 3d. for fines and 3d. for insurance, leaving him 8s. 6d. wherewith to pay rent and subsist. I can only hope this is the exception rather than the rule. At any rate, if the head of the family receives such a pittance it is unreasonable to expect him to be in favour of the abolition of his children as half-timers. Though at the same time, with regard to the employment of the latter, there is the aspect that they are substitutes for adults who are so debarred from working. While from the economic view point—despite the great question of health and physique deterioration of the children—by employing two half-timers the employers save, perhaps, 1s. per week in wages.

Having touched this great phase of wages, it may be explained that the rates of remuneration fluctuate to such an extent that it is a very hazardous thing to attempt to strike even an average of the net weekly takings of any class of linen workers. For the tenters the wages vary from 35s. to 50s., but these are a privileged class of really skilled workers able to superintend everything pertaining to the mechanism of the power looms. Next in scale comes the flax dressers, whose rates at piece-work might be set down as averaging 30s. weekly in Belfast and 29s. in the country. In this estimation the quality of the flax bears much. It is when we come to inspect the wages of the weavers and reelers that there is found vast variance, for while the women weavers earn probably an average of 11s. 6d. the men find their figure to be about 16s., and the female spinners may be set down as earning 11s. 9d.

average. Within recent years the spinners have had their increase of 2s. per week, but consonant with it has been much speeding-up of machinery so that instead of attending ninety or ninety-five spindles the task is now 130 spindles. For flax roughers (men) the figures averages 23s. per week, and probably 2s. less in country districts. Albeit while we may regard the figures as pretty accurate the difficulty is that there is no uniformity of wages rate and manner of working in the mills, each having its own system of wages, rates and bonuses.

It is when we come to the "genteel end" of the linen manufacture—the "warehouses"—that we find matters not entirely satisfactory, and sweating occurs through the persistence of the scheme of "outwork." It is true that the majority of the "making-up" firms do pay good wages and see to the best efficiency of their employees. But, just as in other trades, there are others not so high in *morale*. Miss Galway, the Secretary of the Textile Operative Society, is not given to romancing. She is a plain spoken woman who knows what really hard work is, and is brimful of facts anent the outs and ins of the "making-up" branches. Thus she tells me that conditions in the making-up factories have not improved for the better by the use of higher speed machines. While a couple of women could formerly earn 2s. 6d. per gross between them for stitching and folding handkerchiefs, the same work now done by one girl brings her only 1s. per gross. In former times the output was, perhaps, sixteen dozen per day, but now it will be twenty to twenty-four dozen. Then, for sewing lace around dainty handkerchiefs—those used by society ladies—formerly 3½d. per dozen was paid together with an extra 1d. per dozen for paring away the loose edges. Now, however, for the combined work, *i.e.*, for both stitching and paring—the rate is only 2d. per dozen. It is true that the wareroom girl in the finishing and make-up ends of the industry may earn up to 13s. or so, but she has usually to supply her own thread, and often her needles, and the bigger output means more grist to the manufacturer.

MASTERS' ASSOCIATIONS

The employers have several associations, mainly for the discussion of common business aims and the furtherance of the interests of the industry in general. In the enumeration of these it is just that we give precedence to the Flax Supply Association. It is no modern institution by any means, for its origin was as far back as 1867—nigh half a century ago. As in a large manner the direct successor of the old Linen Board, and later of the Royal Flax Society of Ireland which—after an existence of eighteen years—came to an unexpectedly abrupt end in 1859—it had as first President the late John Mulholland, M.P., who became Lord Dunleath. The ostensible scope of operations of the Flax Supply Association is for the improvement of the culture of flax in Ireland, and the dissemination of information relative to the production and supply of flax, as well as the collection of statistics affecting the entire industry. Undoubtedly it has accomplished very valuable work and seems distinctly flourishing.

Of the other Associations it may be stated that they have been formed rather for the promotion of the welfare of individual branches. Thus the Flax Spinners' Association deals with matters relating to the spinning end; the Power Loom Manufacturers' Association similarly dealing with affairs connected with the manufacturing process; the Bleachers and Finishers Association with things concerning their speciality, and the

Linen Merchants' Association having as its aim the promotion of better modes of merchandising, etc. In the main these provide a platform for the airing of views on all subjects allied with the linen manufacture, but there is little of the nature of close combination in their working.

Although industrial conditions have been hitherto unfavourable to associations of employers having for their object the maintenance of prices, a recent significant development has been the combination of the bleachers in an attempt to advance prices and also to institute important changes in the conditions under which the work is carried on. Last year also saw another of these loose "Combinations," that of "the Cambric Combine." Though not in the strict economic sense a combine at all, its evolution is of interest. In 1912 the trade in cambric yarns had only held its own. However, some of the manufacturers in this branch were evidently not satisfied with anything but an actual boom in trade, and, believing that they had a monopoly of production in this line, they formed what is now known as the "Cambric Combine." The trade in general was given to understand that it was only to regulate production, etc., and that there was no thought of putting up prices, but those who heard this merely smiled. The Combine was not long in existence till a list was issued higher than anything that had been obtained up to then, and this policy was again repeated. The moving spirits in the Combine appeared, however, to have fallen into the old error of reckoning without their host. They imagined they had the monopoly of cambric production, but subsequent efforts have done very much to refute this. Owing to the quietness, not to say, slackness, in plain goods which characterised the second half of 1913, manufacturers with suitable looms—and there are many of them in the trade—were only too glad to turn on to cambrics. After some experimenting it was found that there was no secret whatever in their manufacture, and that a Belfast weaver and loom were just as competent and suitable for the purpose as a similar combination in Portadown or Lurgan. Large quantities of cambric have been, and are being, made outside "the Combine" so its existence seems somewhat ephemeral.

It might be thought that the Linen Merchants' Association was characterised by solidarity, but the converse seems more nearer fact. Speaking at the annual meeting a year or two ago the then President put it that there was great necessity for a greater measure of unity and solidarity of action among the linen merchants. "It was well known to all that other branches of the linen trade had found it advantageous and necessary to bind themselves together as a strong force united. The linen merchants, however, had been accustomed to march in individual lines, with a very irregular frontage. It was not to be implied that the combinations in other sections of that trade were intended to be, or would necessarily become, inimical to the interests of the merchanting end of the business. *The present position of the linen merchants is one of inherent weakness.* As distributors, they stood between combined producers and numberless customers in all countries. Being themselves but slackly organised, they were less able to resist the encroachments from which they constantly suffered."

The failure of collective efforts to limit price-cutting formed a cogent reason for the amalgamation of firms into mighty combines in the allied textile industries —wool and cotton. So far, however, there has been no amalgamation of firms in the linen trade except, perhaps, the Linen Thread Company. But there have been many working agreements among masters for the settlement of wages, for reducing output, and, in one instance, to maintain a minimum price for yarns.

In conclusion, while the conditions of labour, rate of wages, and other influencing circumstances in the linen industry are undoubtedly favourable, and as a whole reasonable, there is one phase that calls for very urgent amelioration. The physique of the girl and woman worker, especially in Belfast, is not ideal. Nor can it be expected to reach such so long as employers cling to the persistence of the old cruel policy of expecting the workers to be at their frames or looms as early as 6 a.m. during the winter season. This inhumane practice is the dire blot on the system and is detrimental both from the health and output aspects alike. On her return from the mill on the previous evening, the worker partakes of a far from nutritious meal, consisting usually of cheap boiled tea and artificially whitened bread, deprived of its real stamina qualities, covered thinly with butter or its substitute. This apology for a solid meal is taken at probably 6.30 p.m., so when the noisy mill hooter sounds in early morning, the stomach is empty and the body vitality almost at its weakest, for nigh twelve hours have elapsed since the last food. It is a quick jump from the cosy bed, and after donning a thin dress—consisting of a petticoat, a thin cotton rag of chemise, and the inevitable drugget shawl—there is a rush outside through the cold, biting blasts of the wintry morning to be in the mill before the closing of the doors, which means the loss of a quarter day's pay.

The electric light is on and the machinery is soon in full swing, but the half-awakened worker stands shivering over the frame or loom, starving, and with little or no concentration in the work, but longing for the whistle denoting the breakfast leisure. Is it any wonder, then, that when four o'clock in the afternoon is reached the worker is tired and half asleep over the loom—careless of what quality of work is being produced ?

Can this system from the view-point of humanity be warranted ?

Can it be commended as the best for either good health, so synonymous with efficiency, good work, or quantity of output ? Against the terrible inroads on the workers' health, the gain, when loss from imperfect work with half utilised power and machinery are taken into account, must stamp this system as fallacious and much opposed to good business economics.

Surely the remedy is simple. Let the worker enter the mill or factory at 8 a.m.—two hours later—with breakfast taken and so fully prepared for good sustaining work. I have spoken to several employers with a view to the removal of this grievance, and while they individually admit it is an iniquitous system, yet the invariable reply is—" I am willing to alter the system if others will do so simultaneously." I now appeal to the linen company directors and manufacturers in general. What is their reply ?

INDEX

AMERICA as Customer, 40
American Civil War, The, and Linen, 60
—— Trade, 39–41
Associations, Bleachers and Finishers, 126
——, Flax Spinners', 126
——, Linen Merchants', 127, 128
—— of Masters, 126
—— of Workers, 122, 123
——, Power Loom Manufacturers', 126

" BALLYMENAS," 84
Belfast Technical Institute, 118, 120
Bleachers' Combine, 126
Bleaching, 74, 84–92
—— Dip, 88
Boiling, 74
Bounties for Linen Encouragement, 14, 25–9, 112
——, Evils of, 28

CAMBRIC Combine, 127
Cambrics, 98
Canvas, 27
Capital and Labour, Cordial Relations between, 122
Competition, 113
Connaught, Linen in, 20
Crommelin, Father of Irish Linen, 9–12

DRESSERS, 124
Dromore, 18
Dyeing, 93

EDUCATION of Workers, 118–121

Egyptians and Linen, 2–4
English Linen Trade, 23

FACTORY System Introduced, 30
Finances of Linen Trade, 34–7
Fineness, reckoning, 105
Finishing, 92
Flax Growing, 42–6
——, Foreign, 56
—— Imports, 55–7
—— Preparing, 48
——, Royal Society, 32, 33
—— Scutching, 52–5
—— Seed, 42
—— Sources, 54
—— Supply Association, 44

GRADING of Linen, 108
Grass Bleaching, 91
Grievances of Workers, 123–4

HACKLING, 63
" Half-Timers," 124
Handkerchiefs, 98–100, 109, 110, 125
Handloom Weaving, 82
Hanks and Cuts, 67
Healthful Improvements, 116
Huguenots as Linen Founders, 10

IMPORTANCE of Linen Trade, 37–9
Imports of Flax, 55, 56
—— of Linen, 40
Improvements for Workers, 116
Iniquitous Morning Work, 129
Irish House of Commons and Linen, 7
—— Linen Board, 14–17, 25–9

Irish Linen Bounties, 14
—— ——, Foundation of, 9, 10

"£ s. d." of Linen Trade, 34–7
Linen in History, 1 *et seq.*
—— Distribution, 111
—— Exports, 39
—— Grading, 104
—— Halls, 22
——, Lapping of, 97
—— Looms, 78
—— Made Abroad, 40
—— Merchants' Association, 128
—— Thread Co., 70
——, to test, 106
——, Varieties of, 97
—— *versus* Cotton, 102–3
Lurgan Cambrics, 98

MACHINES Introduced, 30–2
Making-Up, 109, 112
Markets, Linen, 21, 111
Masters' Associations, 126, 127
Measuring Yarn, 67
Munster, Linen in, 20

OUTWORKERS, 125

"PADDING," 96
"Preparing," 64
Printing and Dyeing, 93–6

RETTING of Flax, 48–51
Riots, Linen, 17

Roving Frame, 66
Royal Flax Society, 32
Russia, Flax Growing in, 46

SCOTCH Linen Trade, 24
Scutching Spinning Begun, 30
"Scutching Tow," 54
Spinning Mills, 58-63
Spreader and Sliver, 66
Sweating Workers, 125

TECHNICAL Education, 105
—— Names, 105
Testing House for Textiles, 106
Textile Classes, 118–121
—— Operative Society, 125
Thread, 70
Trades Unions, 122–3

UNIONS with Cotton, 100
——, Workers' Trades, 122–124

WAGES, 124
Warehouses, 125
Warping, 74
Weaving, Handloom, 82–4
——, 71, 72, 76
Wet Spinning Rooms, 117
Winding and Warping, 71
Work, Conditions of, 124
Workers' Grievances, 123

YARN Exports, 68
—— Measuring, 67

Printed by Sir Isaac Pitman & Sons, Ltd., Bath, England
V—(1456A)

APPENDIX

FIRE HAZARDS INCIDENTAL TO LINEN MANUFACTURE

By James Black

As our readers will have learned from the chapter on Flax Growing, the fibre is not inside the stalk or stem of the flax plant, but outside, and attached to the boon or woody matter which forms the stiff framework of the stalk. In the effort to separate the fibre there is given off great quantities of dust and " shoves," i.e. the broken woody parts of the stalk. These, with tiny bits of fibre, fill the building where the operations are being performed and consequently the hazards of

Scutch Mills

are such that very few companies underwrite them at all. Those who do, charge a premium of from five to eight guineas per cent. Fires are frequent and losses total. In these dust-laden buildings lubrication needs to be very carefully looked to every stopping time. Many fires have occurred from *overheated bearings*. The buildings being for the most part owned by people with small financial resources, the methods of lubrication are of a commonplace kind and machines frequently get clogged with dust. Many fires which have occurred shortly after the mills ceased working, originated at the overheated bearings. *Artificial lighting* is another frequent cause of fire. Some water-driven mills which have power to spare are lit by incandescent electric light, and some steam-driven mills are similarly lighted. When the proviso is met that the switches and cut-outs are external to the building, there is not much to be apprehended from this form of lighting. There are, however, quite a fair proportion of the smaller mills lit by gas or mineral oil lamps. In these cases the gas jet or oil lamp is enclosed in locked reflector lanterns outside the windows of the mills. The use of matches to light these is highly dangerous. The use of, or even the carrying of, matches in the mill or mill yard is fraught with danger. To say nothing of the obvious hazard from spent matches and *surreptitious smoking*, there is the unconsidered risk of fire from the *trodden-on matches* dropped from the pockets of the workers. It is not easy to control the employees, but there is a way of managing not unknown in other industries. This is to provide a little outhouse, say fifty yards from the mill, where smoking is permitted during meal hours, and where a box of safety matches is kept for the convenience of the workers.

For the most part, scutch mills are situated in rather isolated country districts, but not very far from the main highway. The shelter of the mill buildings and the comfort of a couch of tow are very attractive to the *tramp*. This is an unmeasured hazard of fire, varying very much with the situation of the mill and the reputation of the miller. "Love laughs at locksmiths," and tramps are sometimes equally daring. In stress and storm he will take the risk of barbed wire obstacles—an additional rent or two will make no difference—but the most daring of them will hesitate at the bark of a bull-dog and will sneak away at the snarl of an Irish terrier. We recommend watch-dog insurance against the hazard of tramps.

Flax Stores

It is necessary to keep the flax in a comparatively cool chamber, with just sufficient light to admit of free movement. There is, therefore, no hazard of heat and no power other than a lift. There is a standing rule in the trade forbidding any artificial light other than incandescent electric light. Except in an isolated case of a defective installation, we have not had any well certified loss from artificial lighting. We have clear evidence, however, of a £30,000 loss arising from a *trodden-on match*, and have a grave suspicion that some of the losses in Belfast warehouses, not on the mill premises, arose from this cause.

Flax Spinning Mills

These are usually in the hands of wealthy syndicates, who can afford to arrange the works in such a manner as to avoid, or at any rate to minimize, risks of fire. The mill proper is usually a five or six storey building constructed in accordance with the insurance companies' rules, i.e. Standard III fireproof, except the top floor, which answers to Standard IV. Besides the risk of lighting and lubricating incidental to all manufacturing concerns, there are no special hazards in the preparing, spinning, and reeling processes, which are most usually confined to the mill building. We should not, however, omit to refer to a loss of £5,000 which arose from the use of a duck lamp by a greaser when *oiling the shafting* in a boxed-in gearing place. He set fire to the ropes, and, before it could be checked, the conflagration destroyed property to the extent stated. The most serious losses occur in the external heckling rooms, carding rooms, flax stores, and non-fireproof boiler and yarn drying houses. Quite a sensation occurred in a roughing shop—roughing is a process of hand heckling—when a fire started on the operator's bench and was repeated at intervals of a few minutes in the same position. It was traced to a *bead* in the window glazing that focused the sun's rays on the finely dressed flax on the bench. *Ventilation* of these rooms, inasmuch as the draught sucks away tiny fibres which clog the lubrication at the fans, is an occasional cause of fire. They are the more serious that they always occur a few minutes after the power is off and the hands have removed from the premises. Machine heckling fires arise from many causes. These are all the more regrettable because the new automatic machines are so expensive and difficult to replace. There is the danger of foreign substance becoming involved in the fibre ; a *match* fallen from the pocket of a worker or some *hard, gritty matter* which, when operated on by the sharp pins of the machine, may strike fire. Not very long ago two fires were traceable to friction at the cam of the machine. This part, though slow in motion, carries the entire load, so it was not speed but *frictional resistance* which occasioned the fires. In other cases they were occasioned by *short circuiting* above the incandescent lamp holder, by which the latter in a highly heated state fell into a quantity of fibre in the tow box of a heckling machine.

CARDING ROOMS

Arising from the processes of roughing, sorting, and machine heckling, there is a considerable quantity of tow or short ends of flax fibre which, as it possesses a considerable value, is prepared for spinning by an operation called carding. The machine consists of a large drum, say, of 6 feet face, fitted with steel pins, and smaller stripper rollers similarly armed. The cylinder revolves at a high speed, and catches the fibre as it is passed through two feed rollers, other rollers slowly revolving in an opposite direction, whose pins, hooked against those of the cylinder, cut the fibre. A continuous alternating operation of cleaning, equalizing, and splitting is carried on until the fibre issues in the form of a sliver. Fires are not infrequent in carding houses, which are usually fireproof, but they are not disastrous. Perhaps the most frequent cause of fire is *matches* that have found their way amongst the tow in its removal from place to place. Similarly, some *hard and gritty substance* may pass unnoticed into the tow upon which the steel pins will strike fire. The accidental displacement of part of the card clothing, resulting in the *striking of the pins*, is another cause, as is *overheated journals* clogged with dust and fine fibre from the process.

BOILER HOUSES CUM YARN DRYING LOFTS

During the past thirty years many of these have been burned down, and the re-erected buildings have been made fireproof. In the reconstructed buildings the losses have been negligible, but there are still a number of the old non-fireproof type, and in respect of these we have to indicate the specific hazards. In all cases the temperature aimed at is in or about 115° Fah., and it can be readily appreciated that the timbers become so desiccated they will burn with little encouragement. Woody particles and fluff from the stripping operations fall through the trellised floor and gather on the top of the boiler and its brick setting. It is no unusual thing to see sparks occasioned by the movement of the *damper* inside the boiler house, and it is not improbable that from this cause, or the *breach in the setting* by expansion and contraction, loosened yarn blown against an *unprotected gas jet*, yarn carelessly laid on top of the *feed pipe* from the boiler, *matches* dropped from the pocket of the operator, and surreptitious *smoking* are also causes of fire. Boiler and drying loft fires have always been so disastrous, it has been difficult to trace with certainty the actual causes, but it is safe to say that the serious losses have been confined to non-fireproof buildings.

WEAVING

For the most part linen weaving factories are quite separate from the spinning mills, and the remarks that follow apply peculiarly to the operation of weaving and the processes directly incident thereto. As these are at present, the motor is a steam-engine working by rope drive on lines of shafting bisecting the weaving shed, and with bottle lubricators at the various bearings. It is no unusual thing to find a broken bottle, which, of course, interferes with automatic lubrication. *Overheating* of the journal necessarily results, and though this may happen twenty times without much fire resulting, the twenty-first time may be fatal. The fine fluff from the material settles on the pedestal and the timbers to which it is bolted, and this catches fire very easily. Whilst weaving factories generally are, in the experience of insurance companies, a good class of risk, it is a curious thing that about 50 per cent of the accidents by fire (some of them trivial) have arisen at the roof of the shed and in the neighbourhood of the journals.

Waste is usually swept up daily for removal to an external waste shed. An occasional lapse occurs like the following. On Saturday, the usual cleaning-up day in a large damask weaving factory, the ordinary threads and fluff from the manufacture, oil-soaked sweepings from the looms, and the oily wipes used in cleaning the machinery were *not* removed to the *waste* shed, and on the Sunday, which happened to be a sultry day, particularly favourable to spontaneous combustion, the waste in one of the wooden receptacles fired. The flames rose sufficiently high to ignite the harness, and travelled the whole length of the pass. The damage amounted to something like £1,600.

The writer had occasion to survey a new installation of electric light in a damask weaving shed. Through abrasion effected on the pendants hanging over the framework of the loom, the wires were brought into contact, causing two tiny blue jets. Fortunately, the defect was discovered in time to prevent accident. In an old-fashioned factory, a workman was hurrying late to his work and knocked against an *unprotected gas light*, causing it to touch the varnished heddles. The result was a conflagration which swept the factory from end to end.

What is known as the humidifier, by which a series of jets of steam are vented into the shed in order to soften the atmosphere for the worker and incidentally to assist the operations, is usually the only method of heating, but there are various ways of doing this. We are not concerned with the humidifier proper. The feed steam pipes, often only half an inch in diameter, are sometimes improperly carried through wooden partitions, and in positions where they are used by workers as hanging conveniences. A *defective heating plant* of this kind occasioned a fire beside a cropping machine in a coarse linen weaving factory.

BLEACHING, PRINTING, AND DYEING

There is little fire hazard in the process of bleaching, but there have been one or two fires traced to the beetling operations following bleaching. A *broken "gudgeon"* or sliding guide induced such friction as fired the machine. In another case, a *broken "Wyper" beam*, a revolving beam with projections, which lift the hammers or beetling pins, had the same result. In both cases the lessons were severe, though they were separated by many years.

Printing has a very different record. Hand printing is not so bad. The only fires which have occurred in that connection have been in the ageing room, in which the colours are developed, or the room in which the material is bunched after passing through the ageing. The aniline used in printing has such an affinity for oxygen there is grave danger of *spontaneous ignition* if the material be bunched for any length of time. So many fires have arisen from this cause that it is now an imperative rule that goods taken from the ageing room must be cooled or immersed in liquid. Machine printing is subject to the same danger in an aggravated form. Beside the hazards of oxidation, there is an accumulation of hazard from the *feed pipes* to steam-heated rollers, the shredded bits of *oil-soaked cloth*, the use of *spirit* to prevent frothing of colours, the *bunching* of cloth at week-ends or in holiday time, and from each of these causes fires have been traced. It is a remarkable fact that in Ireland, the centre of the linen trade, the number of cloth printing works that have been destroyed by fire is out of all proportion to the experience elsewhere.

There are several hazards common to all kinds of dyeing, such as steam pipes, surreptitious smoking, cylinder drying and waste, but experience has taught us that the hazards are quite inappreciable, except in connection with aniline black dyeing. Even there they are greatly modified by the practice of the trade, brought into action after a searching inquiry into the causes of fires by the insurance companies twenty years ago. Broadly speaking, the danger in this case arises from the *bunching of goods* after they have been rough dried in the steam-heated cylinders. If the mordanting and dyeing processes have been completed and the goods are rough dried after starching, the only damage that would arise from bunching would be slight discoloration from the fermentation of the starch. Several of the most disastrous fires occurred after the mordanting or dyeing stage. However, as has been already hinted, the practice is now quite general to perform all three operations on the same day, so the losses in dyeworks are greatly reduced.

From all that has been written, the reader will very naturally conclude that most of the fire hazards of the linen industry resolve themselves into a question of management. Discipline is of the first importance in efficient management. Generally speaking, direct personal control is the most effective, when wisely and continuously exercised. Management that ensures careful oversight, alertness, and subdivision of labour will evoke in the worker a certain responsive pride that makes for interest in detail and that counts for much in the matter of fire hazard.

DATE DUE

OC 30 '80			
GAYLORD			PRINTED IN U.S.A.

MARYGROVE COLLEGE LIBRARY
Linen
677.1 M781
3 1927 00034229 2

2

677.1
M78l

Moore, Alfred S.
Linen

677.1
M78l